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U. S. DEPARTMENT OF THE INTERIOR
PROTOTYPE OIL SHALE LEASING PROGRAM

OIL SHALE TRACT C-b
ENVIRONMENTAL MONITORING REPORT
(June 1982 through December 1982)

Submitted to:

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TENNECO SHALE OIL COMPANY
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BIOLOGY

2.5 Biology

Studies required by the Interim Monitoring plan are contained in this section and are listed in the table of contents.

Several biology monitoring stations were discontinued during the Interim Monitoring Program. Table 2.5-1 presents a list of stations to be continued during this phase.

Monitoring stations referenced in this section are located on Figure 2.5-1, Biological Development Monitoring Program.

All monitoring stations are referenced by four-digit computer station codes. A cross-reference of the computer codes and station ID appear in section 4.0 (Data Automation).

TABLE 2.5-1

BIOLOGICAL MONITORING PROGRAM DURING THE INTERIM PHASE

Programs	General Location	Computer Code
Deer Mortality	North Side of Piceance Creek	BD01 BD02 BD03 BD04 BD05 BD06
	South Side of Piceance Creek	BD07 BD08 BD09 BD10
Deer Age Class	General Area of Tract	BF01
Lagomorph Abundance	Identical Locations to Deer Pellet Group Densities	BA01 to BA49
Small Mammals	Piceance Creek (Development)	BG01
	On-Tract-West	BG02
	Piceance Creek (Control)	BG03
	On-Tract-East	BG04
	Sprinkler Area Section B	BG05
	Sprinkler Area (Control)	BG11
	Sprinkler Area (Development	BG22
	Sprinkler Area (Control)	BG33
Raptors	The Entire Tract and Surrounding Study Areas.	BI01
Aquatic Ecology		
Benthos	USGS 09306007 (Control)	WU07
	USGS 09306058 (Development)	WU58
	USGS 09306061 (Development)	WU61
Periphyton	Piceance Creek Upstream (Control)	WP01 WP02
	Piceance Creek Downstream (Development)	WP03
Water Quality	USGS 09306061 (Development)	WU61

Vegetation				
Community Structure	Plots	*	**	***
	Chained pinyon juniper (1978)(Dev)	BJ01	BJ11	BJ21
	Chained pinyon juniper (1978)(Cont)	BJ02	BJ12	BJ22
	Upland sagebrush (1980)(Cont)	BJ03	BJ13	BJ23
	Bottomland sagebrush (1980)(Cont)	BJ04	BJ14	BJ24
	Pinyon juniper woodland (1979)(Dev)	BJ05	BJ15	BJ25
	Pinyon juniper woodland (1979)(Cont)	BJ06	BJ16	BJ26

* Fenced (8'high) - Used for Community Composition and Structure
** Open
*** Fenced (4'high) - Used for Herbaceous Productivity and Utilization.

Deer Pellet Group Densities

Vegetation Type	Location	Treatment	Transect (Computer Code)
CPJ	Off Tract	Control	BA01
			BA02
			BA03
			BA04
			BA05
			BA06
			BA07
			BA08
			BA09
	On Tract		BA17
			BA18
			BA25
			BA28
			BA29
			BA30
			BA31
CPJ	On Tract	Development	BA32
		Sprinkler	BA20
		Development	BA21
			BA23
PJ	Off Tract	Control	BA13
			BA14
			BA15
		Development	BA10
			BA11
			BA12
			BA16
	On Tract	Control	BA19
			BA26
			BA27
		Development	BA22
			BA24
Brush Beaten* SB	Off Tract	Development	BA41
			BA42
			BA43
			BA44
			BA45
			BA46
			BA47
			BA48
			BA49

Program	General Location	Computer Code
Micro Climate	MC Sta. 1	BC01
	2	BC02
	3	BC03
	4	BC04
	5	BC05
	6	BC06
	7	BC07
	8	BC08
	9	BC09
	13	BC13
Traffic Count	Rio Blanco Store	BT01
	South of Cattle Guard	BT02
	Rio Blanco Lake	BT03

TABLE 2.5-1 (CONT)

Herb Productivity and Utilization: Same locations as community structure plus the following:

1) Range Cage Averages:

Vegetation Type	Computer Code	
	Outside Cages	Inside Cages
CPJ	BK01	BK11
US	BK03	BK13
BS	BK04	BK14
PJ	BK05	BK15

2) Topsoil Piles:

Location	Computer Code
#12-West of Mine Support Area (Seeded in 1978)	BP01

3) Brush Beating Areas:

Oldland Gulch	BU01
Gardenhire Gulch	BU02
Control	BU03

4) Irrigation/Fertilization Treatment Areas:

Computer Code	Treatment Number	Years Fertilized	Fertilized Rate Lbs/Acre	
			N	P
BL11	1a	Not Fertilized		
BL21	1b	Not Fertilized		
BL31	3a1	1980	100	100
BL41	3b1	1980	100	100
BL51	4a1	1980	200	100
BL61	4b1	1980	200	100
BL32	3a2	1980, 1981	100	100
BL42	3b2	1980, 1981	100	100
BL52	4a2	1980, 1981	200	100
BL62	4b2	1980, 1981	200	100
BL80-Open Areas		Not Fertilized		
BL81-Closed		Not Fertilized		

Shrub Productivity and Utilization:

Browse (Bitterbrush) Production & Utilization
77-78, 78-79, 79-80, 80-81

Vegetation Type	Location	Treatment	Transect (Computer Code)
CPJ	Tract C-b	Control	BA17
			BA18
			BA25
			BA30
		Development	BA21
			BA23
		Development, Sprinkler	BA20
		Irrigation	BA32
	Big Jimmy Ridge	Control	BA19
			BA04
			BA06
			BA09
PJ	Tract C-b	Control	BA19
			BA26
			BA27
		Development	BA16
			BA22
			BA24

General Condition:

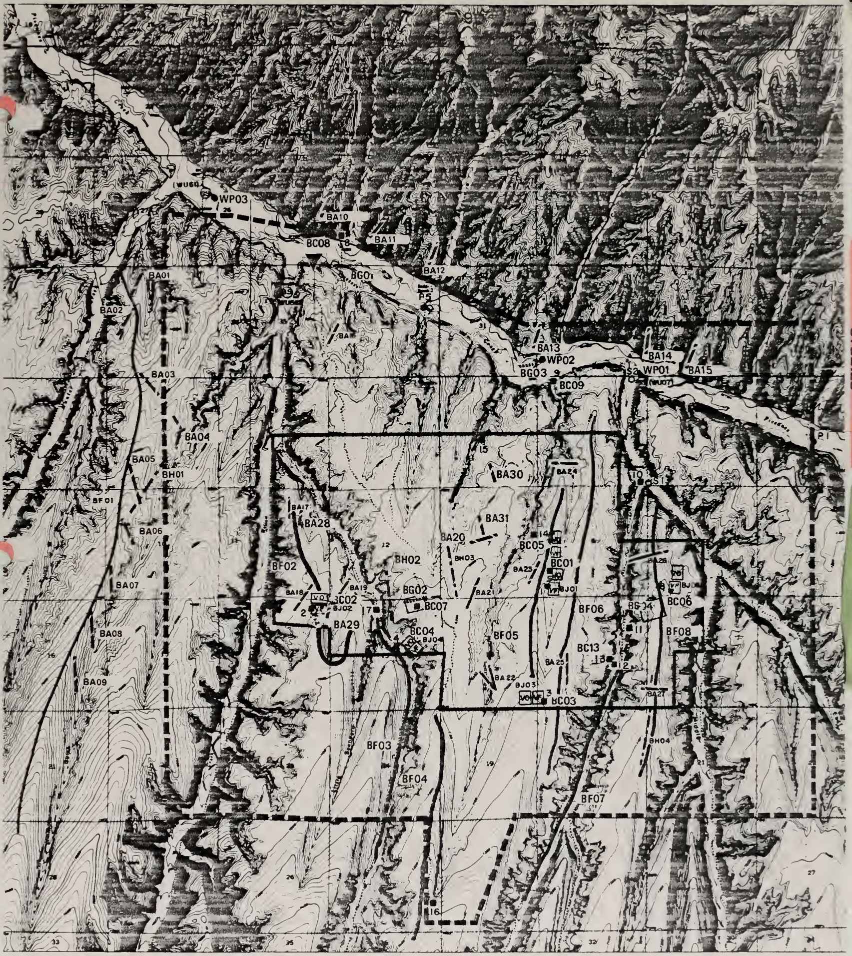
By Landsat over selected Tract areas - not in computer data base; discontinued during Interim phase.

TABLE 2.5-1 (CONT)

Biology (Cont'd)

Programs: Deer Distribution & Migration and Road Kills

Mile Marker	Location	Computer Code: North & East of Piceance Creek Road	Computer Code: Meadows; South & West of Piceance Creek Road
41	White River City	BN41	BM41
40	Piceance Bridge	BN40	BM40
39	Lower Canyon	BN39	BM39
38	Piceance Canyon	BN38	BM38
37	Yellow Creek	BN37	BM37
36	Stinking Springs	BN36	BM36
35	Old Bridge	BN35	BM35
34	Little Hills Turnoff	BN34	BM34
33	Old Corrals & Buildings	BN33	BM33
32	Burk Ranch	BN32	BM32
31	Ranch	BN31	BM31
30		BN30	BM30
29		BN29	BM29
28	Bureau of Mines	BN28	BM28
27	Ryan Gulch	BN27	BM27
26	Pump Station	BN26	BM26
25		BN25	BM25
24	Rock School	BN24	BM24
23	AQ 021	BN23	BM23
22	Pat Johnson's Ranch	BN22	BM22
21	Hunter Creek	BN21	BM21
20	PL Gate	BN20	BM20
19	AQ 020	BN19	BM19
18	Sorghum, Cottonwood	BN18	BM18
17	Stewart Gulch Rd.	BN17	BM17
16	AQ Trailer 022	BN16	BM16
15	Oldland's Ranch	BN15	BM15
14	Oldland's Ranch	BN14	BM14
13	Pond and Cabin	BN13	BM13
12	Sprague Gulch	BN12	BM12
11	Cascade Gulch	BN11	BM11
10	13 Mile Gulch	BN10	BM10
9	14 Mile Gulch	BN09	BM09
8	Schutte Gulch	BN08	BM08
7	Robinson's Ranch	BN07	BM07
6		BN06	BM06
5	2 Old Cabins (35 MPH Curve)	BN05	BM05
4	McCarthy Gulch	BN04	BM04
3	Cow Creek	BN03	BM03
2	Mahogany Outcropping	BN02	BM02
1	Woodward Ranch	BN01	BM01
0	Rio Blanco Store	BN00	BM00



- (GS) Water Gaging Station - Benthos
- VO / VF Vegetation Site: VO = Open (50 x 70 m) VF = Fenced (50 x 70 m)
- Microenvironmental Station
- Fish Sampling
- Periphyton
- Animal Trap Site
- Deer Pellet and Browse Utilization Transects
- Ornithological Gamebird Study Transects
- Predator Survey Lines
- Other Sensitive Areas

BIOLOGICAL DEVELOPMENT MONITORING PROGRAM

Figure 2.5-1

2.5.1 Terrestrial Wildlife Studies

Data were collected in summer 1982 for deer migrational patterns and phenology, road kills, natural mortality, browse production and utilization studies, lagomorph abundance, small mammal populations, and raptor nesting.

2.5.1.1 Big Game: Mule Deer

2.5.1.1.1 Deer Pellet Group Densities

Thirty-nine deer pellet transects of 20 - 0.01 acre plots each were sampled in the summer of 1982. Locations of the transects are shown on Figure 2.5-1 (designated as BA$$). Eighteen transects were sampled in chained rangeland areas, 12 were sampled in pinyon-juniper woodland, and 9 were sampled in brush-beaten sage areas. A tabular summary of pellet-group data for 1981-82 is presented in Table 2.5.1.1-1.

Results of mule deer pellet-group counts for 1981-82 will be discussed as three topics: 1) a general, non-quantitative, impact evaluation of Tract C-b development activities over the past five years; 2) a quantitative analysis of a local impact, discussed primarily to illustrate one of several analytical procedures; and 3) an evaluation of the present success of the brush-beating mitigation program.

Figures summarizing deer pellet-group monitoring data (Figures 2.5.1.1-1 and -2) have been modified this year to accomodate the expanding data base, and to better portray long-term patterns and trends. Transect designations have been ordered from low to high on the basis of mean pellet-group density estimates over the past five years. The figures have been designed to make the following features conspicuous should they occur: 1) a trend toward lower values at transect locations close to development activities, accompanied by a possible trend toward higher values at control areas (indicative of a permanent displacement of deer from areas near development); 2) a temporary shift toward lower values at localized disturbance sites (indicative of short-term displacements); 3) returns to previous density values following localized impacts (indicative of habituation to disturbances); and 4) any consistent pattern in the data that provides insight into the manner in which deer use the area on a year-to-year basis.

An impact evaluation of development activities on the local mule deer population over the past five years can be performed in a general way by examination of Figures 2.5.1.1-1 and -2. A dashed line has been drawn to connect data points of the first year, the winter of 1977-78; this year is baseline in that major development activities began during the summer of 1978. A solid line has been drawn through 1981-82 data points merely to highlight this past year. Transect locations originally defined as "development" (in contrast to "control") are circled along the x-axes of both figures. The original development designation was retained to indicate those transects that are in close proximity to major construction activities. Using this criterion of development-control sites, it is clear that deer pellet-group densities have not declined since 1977-78 at the development locations. In addition, there is no indication of a yearly trend toward higher values at control locations.

The original designations of development and control transects must necessarily change in certain years, however, since unanticipated disturbances sometimes occur. For example, a drill rig was operating between transects BA06 and BA07 from September 1981 to April 1982. Because of noise and visual disturbances, it was considered likely that wintering deer might be temporarily displaced from the immediate vicinity. This hypothesis was tested mainly to evaluate the sensitivity of deer pellet-group monitoring data in terms of its usefulness in detecting localized impacts. Thus, the purpose of the following discussion is to illustrate an analytical procedure, not to provide an argument that an impact of some

TABLE 2.5.1.1-1

Deer pellet group densities, 1981-82.

Transect	Mean pellet groups per .01 acre plot +/- SE (n)*
Chained rangeland:	
BA17	1.60 +/- 000.33(20)
BA18	4.20 +/- 000.64(20)
BA25	4.90 +/- 000.61(20)
BA20	7.75 +/- 001.06(20)
BA21	6.45 +/- 000.96(20)
BA23	4.00 +/- 000.81(20)
BA01	4.70 +/- 000.59(20)
BA02	6.15 +/- 000.99(20)
BA03	3.95 +/- 000.58(20)
BA04	7.05 +/- 000.83(20)
BA05	3.35 +/- 000.52(20)
BA06	1.25 +/- 000.41(20)
BA07	0.80 +/- 000.32(20)
BA08	3.15 +/- 000.65(20)
BA09	0.50 +/- 000.21(20)
BA30	2.45 +/- 000.49(20)
BA31	4.25 +/- 000.53(20)
BA32	6.70 +/- 000.76(20)
Pinyon-juniper woodland:	
BA19	1.45 +/- 000.30(20)
BA26	1.25 +/- 000.32(20)
BA27	2.95 +/- 000.70(20)
BA16	1.80 +/- 000.43(20)
BA22	3.05 +/- 000.56(20)
BA24	1.55 +/- 000.49(20)
BA10	1.25 +/- 000.38(20)
BA11	0.95 +/- 000.25(20)
BA12	1.40 +/- 000.39(20)
BA13	4.75 +/- 000.80(20)
BA14	5.85 +/- 000.93(20)
BA15	4.30 +/- 001.02(20)
Brush-beaten sage:	
BA41	0.80 +/- 000.25(20)
BA42	1.45 +/- 000.44(20)
BA43	0.65 +/- 000.15(20)
BA44	7.00 +/- 000.74(20)
BA45	1.25 +/- 000.30(20)
BA46	1.05 +/- 000.25(20)
BA47	3.85 +/- 000.75(20)
BA48	0.90 +/- 000.20(20)
BA49	0.70 +/- 000.21(20)

* n = number of 0.01 acre plots sampled.

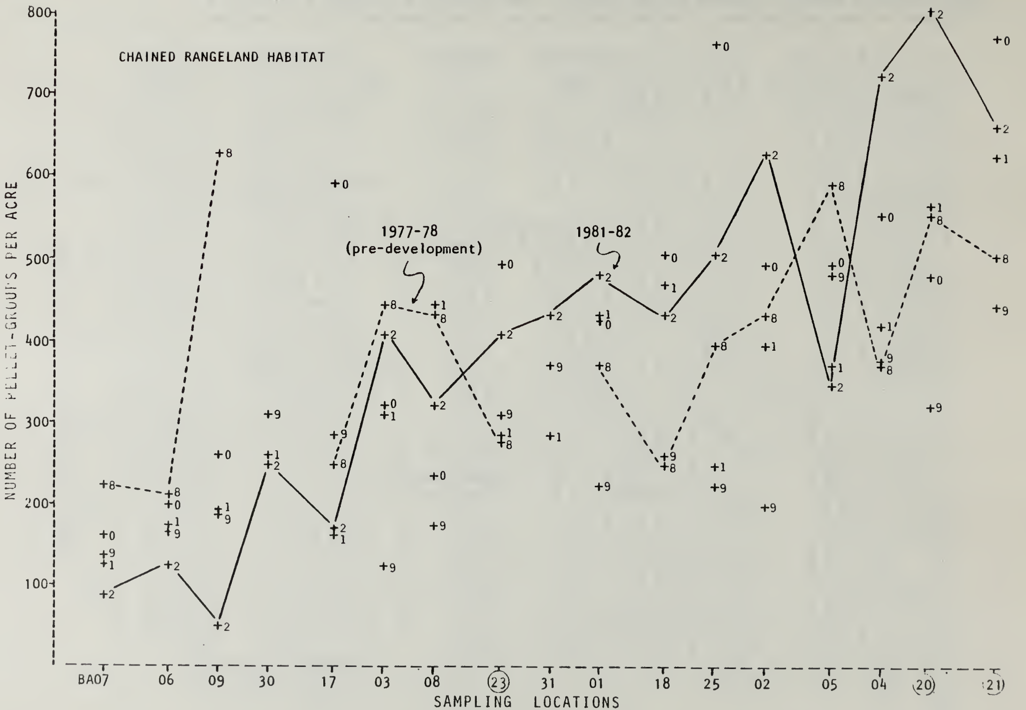


FIG. 2.5.1.1-1 Mule deer pellet-group densities in chained rangeland habitat. Years are indicated by numerals: 8 = 1977-78, 9 = 1978-79, 0 = 1979-80, etc. Circled sampling locations indicate locations close to development activities.

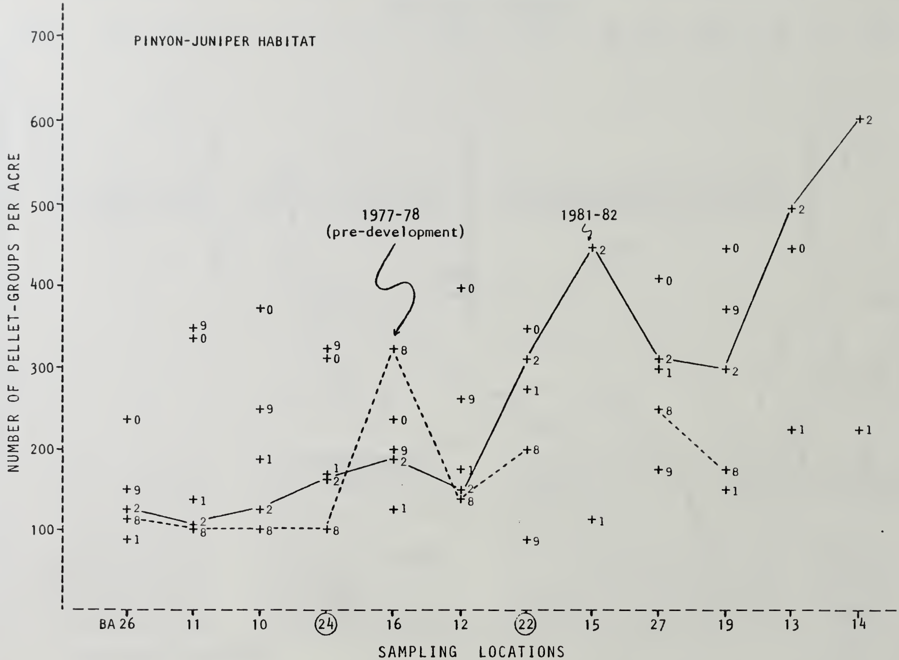


FIG. 2.5.1.1-2 Mule deer pellet group densities in pinyon-juniper habitat. Years are indicated by numerals: 8 = 1977-78, 9 = 1978-79, 0 = 1979-80, etc. Circled sampling locations indicate locations close to development activities.

consequence has occurred. Locations BA06 and BA07 have values for 1981-82 that are lower than any previous year (Figure 2.5.1.1-1), suggesting that deer might well have been displaced by the operation of the drill rig. The null hypothesis of no difference between 1982 pellet-group densities and previous years at transects BA06 and BA07 was tested as follows: differences in density estimates between 1982 values and mean values of all previous years were calculated for each transect location, and expressed as normal deviates ($Z = X-\bar{X}/SD$). Values at transects BA06 and BA07 for 1982 were then compared to a table of normal deviates to obtain the probabilities of randomly obtaining values this low.

Probabilities for stations BA06 and BA07 respectively were P=.14 (86% level) and P=.07 (93% level). The conclusion, therefore, is that deer seem likely to have been displaced by the operation of the drill rig, particularly at BA07 where the confidence level exceeds 90 percent. If BA05 and BA09 are omitted from the analysis (which might be justified since they were near the drill rig as well) confidence levels for both BA06 and BA07 exceed the 95% level. It should be mentioned that the validity of this method strongly depends on the precision of the means for pre-impact years (the more pre-impact, i.e., baseline, years the better). Also it is assumed that the difference between 1982 values and mean values for previous years are normally distributed (thus, the more control transects the better). For the present example, sufficient years and sufficient control transects are available to provide a reasonably strong argument that deer were displaced from the immediate vicinity of the drill rig.

An evaluation of the success of sagebrush brush-beating was again evaluated this year using deer-pellet group data. A comparison of differences between treatment and control plots was estimated using a 2-level nested ANOVA (Table 2.5.1-2). Differences were not significant (F=1.09, df=1,7; P=.33).

2.5.1.1.2 Browse Production and Utilization

A summary of the past five years of bitterbrush investigations is presented this year in Figures 2.5.1.1-3 and -4. These figures are similar in format to those used for summarizing deer pellet-group data (Figures 2.5.1.1-1 and -2). Also, they have been prepared with the same objectives in mind; namely, to accommodate the expanding data base and to better portray long-term patterns and trends. As elaborated in the deer pellet-group discussion, the new figures facilitate visual inspection of data points suggestive of disturbance effects.

It will be noted that the biological variable plotted in Figures 2.5.1.1-3 and -4 is percent utilization. This variable is considered a more important browse measurement than degree of hedging--length of shoots remaining after winter browsing (see Section 2.5.1.1.7, Interrelationships). Estimates of hedging, however, as well as browse production are presented in Table 2.5.1.1-3.

TABLE 2.5.1.1-2 Comparison of mule deer pellet-group counts in brush-beaten sagebrush with control areas.

TWO-LEVEL NESTED ANOVA:

Source of Variation	DF	MS	F	Variance Components
Between brush-beaten and control areas	1	97.68	1.09	1.1%
Among subgroup plots	7	89.87	24.95	53.9%
Within plots	171	3.60		45.0%

F (.05; df=1,7) = 5.59 F (.05; df=7,171) =2.07

Transect Means +/- SE (n) =

Brush-beaten		Control	
BA41	80 +/- 25 (20)	BA43	65 +/- 15 (20)
BA42	145 +/- 44 (20)	BA44	700 +/- 74 (20)
BA45	125 +/- 30 (20)	BA47	385 +/- 75 (20)
BA46	105 +/- 25 (20)	BA48	90 +/- 20 (20)
		BA49	70 +/- 21 (20)

Conclusion: No difference in pellet-group densities between brush-beaten and control areas. See text for discussion.

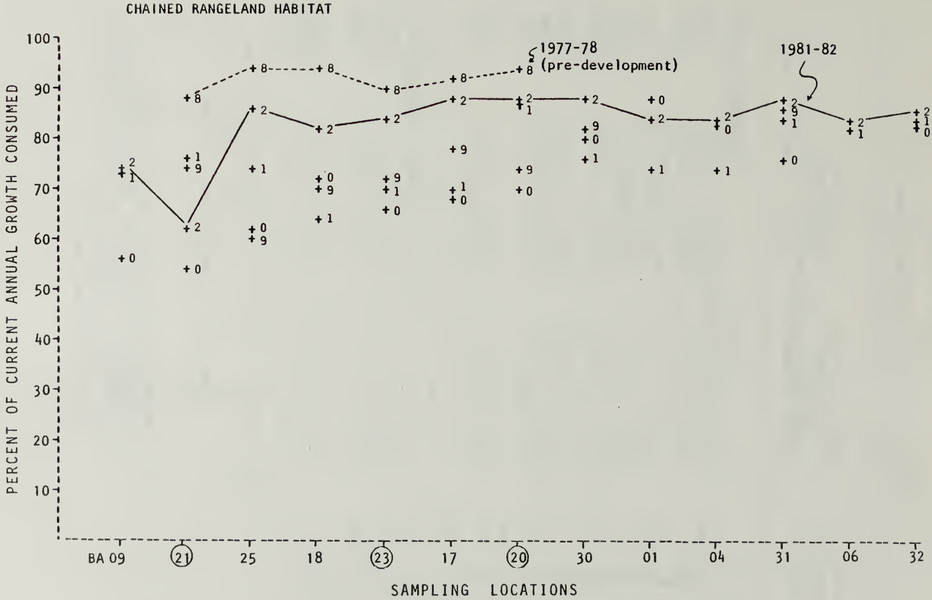


FIG. 2.5.1.1-3 Percent utilization of bitterbrush by mule deer in chained rangeland habitat. Years are indicated by numerals: 8 = 1977-78, 9 = 1978=79, 0 = 1979-80, etc. Circled sampling locations indicate locations close to development activities.

PINYON-JUNIPER HABITAT

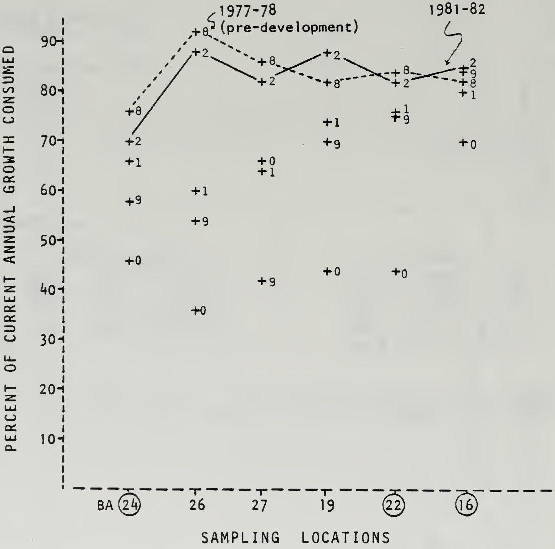


FIG. 2.5.1.1-4 Percent utilization of bitterbrush by mule deer in pinyon-juniper habitat. Years are indicated by numerals: 8 = 1977-78, 9 = 1978-79, 0 = 1979-80, etc. Circled sampling locations indicate locations close to development activities.

TABLE 2.5.1.1-3

Browse production and utilization, 1981-82.

Transect	A PRODUCTION length of new shoots in fall (mm) Mean +/- SE (n)*	B Length of shoots remaining in spring (mm) Mean +/- SE (n)	C UTILIZATION in percent $C = \frac{A-B}{A} x100$
CHAINED RANGELAND:			
BA17	99 +/- 12.6 (10)	13 +/- 2.9 (10)	87
BA18	93 +/- 9.3 (10)	18 +/- 3.7 (10)	81
BA25	71 +/- 10.1 (10)	11 +/- 2.4 (10)	85
BA01	111 +/- 15.3 (10)	18 +/- 3.1 (10)	84
BA04	172 +/- 30.8 (10)	27 +/- 5.3 (10)	84
BA06	75 +/- 9.4 (10)	12 +/- 1.8 (10)	84
BA09	82 +/- 8.5 (10)	22 +/- 2.8 (10)	73
BA30	102 +/- 6.5 (10)	13 +/- 2.1 (15)	87
BA31	100 +/- 7.9 (15)	13 +/- 1.9 (15)	87
BA32	152 +/- 13.3 (15)	22 +/- 2.3 (15)	86
BA20	103 +/- 6.4 (10)	12 +/- 2.2 (10)	88
BA21	82 +/- 11.1 (10)	31 +/-11.0 (10)	62
BA23	144 +/- 24.9 (10)	23 +/- 5.2 (10)	84
PINYON-JUNIPER WOODLAND:			
BA19	86 +/- 10.8 (10)	11 +/- 2.3 (10)	87
BA26	75 +/- 6.7 (10)	9 +/- 3.0 (10)	88
BA27	85 +/- 5.4 (10)	16 +/- 3.7 (10)	81
BA16	87 +/- 6.3 (10)	15 +/- 1.6 (10)	83
BA22	97 +/- 9.7 (10)	18 +/- 4.4 (10)	81
BA24	71 +/- 7.7 (10)	21 +/- 2.9 (10)	70

* n = number of shrubs sampled.

Dotted lines and solid lines are again used to facilitate inspection for disturbance effects. It can be readily seen upon examination of Figures 2.5.1.1-3 and -4 that no suspiciously low values indicative of important impacts are present. What is evident, however, is a rather uniform intensity of browsing over both the chained rangeland and pinyon-juniper habitats. This is somewhat in contrast to pellet-group count results (Figures 2.5.1.1-1 and -2), where some locations tend each year to be more heavily used by deer than others.

Sagebrush ocular estimate data are presented in Tables 2.5.1.1-4 and -5. Utilization in the high use category seems to be declining. Table 2.5.1.1-6 presents the results of the Chi-Square Test on sagebrush estimates. The null hypothesis was rejected in the majority of the cases, indicating the high variability between the years of data.

2.5.1.1.3 Migrational Patterns and Phenology

Documentation of mule deer phenology and distributional patterns along Piceance Creek as determined by road counts are presented in Table 2.5.1.1-7 and Figure 2.5.1.1-5. The high count in the fall was 306 deer while the spring count was 809 deer. Comparisons of these results with previous years' findings, particularly of meadows adjacent to Tract C-b, suggest no displacements of deer due to development activities.

2.5.1.1.4 Road Kill

Roadkill data are presented in Table 2.5.1.1-8. Figure 2.5.1.1-6 gives the breakdown of roadkills by mile. The deer roadkill data were analyzed using Chi-Square Test which is presented in Table 2.5.1.1-9. The test results indicate that the roadkill data are highly variable. As in previous years, the breakdown of class is similar. Does were the most killed, followed by fawns and then bucks as shown on Table 2.5.1.1-10.

2.5.1.1.5 Natural Mortality

Deer mortality, as estimated by spring counts of carcasses at permanent study sites, was very low during the winter of 1981-82. Only two carcasses were found (Table 2.5.1.1-11). It is assumed that the low mortality relates to a comparatively mild winter, healthy herd, and good range condition.

2.5.1.1.6 Age-Class Composition

Survival rate of fawns entering into the winter was 81.8 fawns per 100 adults (see Table 2.5.1.1-12). The small sample size may have biased the results. However, the high spring survival rate of 61.1 fawns per 100 adults seems to indicate that a large number of fawns were present at winter's start. This is the highest fawn survival estimate recorded since 1978.

TABLE 2.5.1.1-4

SAGEBRUSH OCULAR ESTIMATED - SUMMER 1982

CHAINED P-J HABITAT

ransect	Sample Size	Paces	Growth Form Young	Mature	Decadent	Utilization Low	Medium	High	Density
01	50	3	14	36	-	49	1	-	4-2-0-2-2 = 14
04	50	3	6	44	-	49	1	-	6-7-7-5-5 = 30
07	50	3	14	35	1	45	5	-	7-11-13-4-3 = 38
09	50	3	9	38	3	40	10	-	11-6-13-7-5 = 42
17	50	3	10	40	-	50	-	-	13-2-2-4-3 = 24
18	50	3	11	38	1	37	12	1	1-10-5-11-3 = 30
20	50	3	16	34	-	32	18	-	3-3-7-5-3 = 21
21	50	3	5	45	-	44	6	-	7-9-8-0-5 = 31
23	50	3	14	36	-	36	14	-	5-4-5-6-2 = 22
25	50	3	5	43	2	40	10	-	7-7-5-4-2 = 25
30	50	3	6	44	-	37	13	-	3-1-3-5-2 = 14
31	50	3	9	41	-	34	15	1	3-4-7-5-9 = 28
32	50	3	13	36	1	40	9	1	1-5-3-7-3 = 19
OTAL	650	-	132	510	8	533	114	3	338
ERCENT			20.3	78.5	1.2	82.0	17.5	0.5	

PINYON JUNIPER HABITAT

ransect	Sample Size	Paces	Growth Form Young	Mature	Decadent	Utilization Low	Medium	High	Density
10	25	3	-	21	4	12	11	2	1-2-0 = 3
11	25	3	1	16	8	9	15	1	4-1-1 = 6
12	25	3	-	19	6	10	10	5	1-2-4 = 7
13	25	3	-	25	-	4	15	6	4-1-5 = 10
14	25	3	-	16	9	8	13	4	5-1-3 = 9
15	25	3	-	19	6	8	13	4	4-4-0 = 8
16	25	3	-	18	7	14	11	-	4-1-2 = 7
19	25	3	-	14	11	20	5	-	1-3-1 = 5
22	25	3	-	18	7	22	3	-	0-1-1 = 2
24	25	3	1	21	3	13	11	1	2-1-2 = 5
26	50	3	-	25	25	28	17	5	2-4-1-1-1 = 9
27	50	3	2	34	14	25	23	2	1-0-3-1-3 = 8
OTAL	350	-	4	246	100	173	147	30	79
ERCENT			1.1	70.3	28.6	49.4	42.0	8.6	

:26

TABLE 2.5.1.1-5

SAGEBRUSH OCULAR ESTIMATE
1978 - 1982

CHAINED PINYON JUNIPER HABITAT

Year	Growth Form Young	Growth Form Mature	Growth Form Decadent	Utilization Low	Utilization Medium	Utilization High	Shrub Density
1982	20.3	78.5	1.2	82.0	17.5	0.5	338
1981	28.8	68.6	2.6	64.9	32.0	3.1	259
1980	19.5	73.3	6.2	54.0	40.0	6.0	339
1978	7.2	88.0	4.8	41.9	39.3	18.8	309

PINYON JUNIPER HABITAT

Year	Growth Form Young	Growth Form Mature	Growth Form Decadent	Utilization Low	Utilization Medium	Utilization High	Shrub Density [1]
1982	1.1	70.3	28.6	49.4	42.0	8.6	79
1981	1.4	76.2	22.2	45.9	40.0	14.1	97
1980	2.3	52.4	45.3	17.7	38.7	43.6	98
1978	0	48.6	51.4	5.8	40.4	53.8	88

[1] Sagebrush plants/acre = $\frac{\text{Number of shrubs counted}}{\text{Number of sample points}}$ X Basal Area Factor

Basal Area Factor = 40

D:26

TABLE 2.5.1.1-6 Comparisons of Sagebrush Ocular Estimates (1978-1982) Using Chi-Square Test

Ho: There are no differences between year to year sagebrush ocular estimates.

Ha: There are differences between year to year sagebrush ocular estimates.

CHAINED PINYON - JUNIPER HABITAT

Category	X^2	Null Hypothesis ($X^2_{0.05,3}=7.815$)
Young	12.65	Reject
Mature	2.69	Accept
Decadent	4.03	Accept
Low	14.33	Reject
Medium	10.17	Reject
High	27.84	Reject
Density	13.56	Reject

PINYON - JUNIPER HABITAT

Category	X^2	Null Hypothesis ($X^2_{0.05,3}=7.815$)
Young	3.45	Accept
Mature	8.76	Reject
Decadent	15.35	Reject
Low	45.98	Reject
Medium	0.08	Accept
High	48.70	Reject
Density	2.62	Accept

D:26

TABLE 2.5.1.1-7

DEER ROAD COUNT

JUNE 1982 - DECEMBER 1982

	SEP	OCT			DEC	
MILES	29	6	13	20	15	24
BM00		61	27	51	26	9
BM01					4	1
BM02		5			9	8
BM03				6		5
BM04					3	1
BM05			1		2	
BM06			3			
BM07						4
BM08						2
BM09				25	9	25
BM10			1	48		
BM11				21	4	
BM12				28		
BM13				3		
BM14				2		
BM15				14		
BM16			10	47		
BM17				63		2
BM18			62	**		
BM19			7	40	3	
BM20			12	34		
BM21			4	14		
BM22				44	1	
BM23				3		
BM24			5		3	7
BM25					1	
BM26		3				
BM27						
BM28						3
BM29						4
BM31				4		
BM32						
BM33						
BM34						
BM35						3
BM36						
BM37					4	
BM38						9
BM39						7
BM40						7
BM41	1					
TOTAL	1	69	**	**	69	97

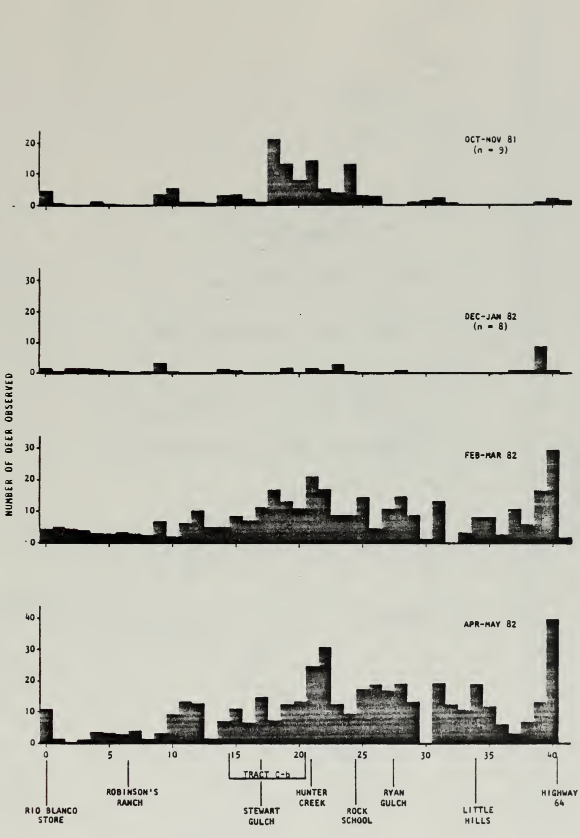


FIG. 2.5.1.1-5

Summary of deer counts for 1981-82. Heights of bars are means; sample sizes (n) are the number of road counts for the period.

TABLE 2.5.1.1-8

DEER ROAD KILL

JUNE 1982 - DECEMBER 1982

MILES	82 SEP 29	OCT 6	13	20	DEC 15	22	29
00			1				
09						1	
11					1		
19					1		
24							1
34					1		
39					1		
TOTAL			1		4	1	1

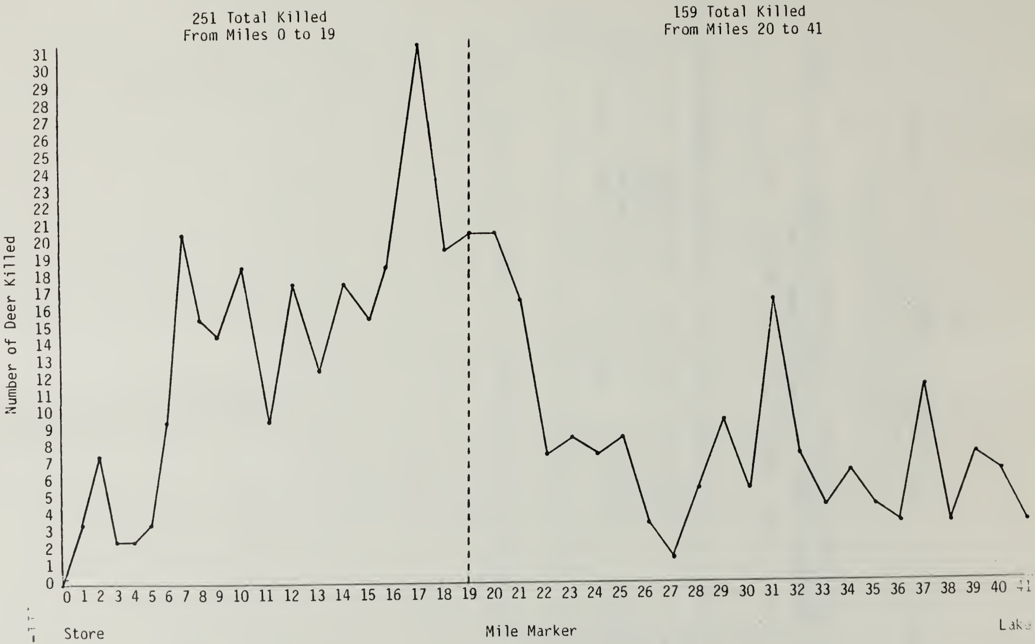


FIGURE 2.5.1.1-6

Accumulative Piceance Creek Road Kill (1977-82)

TABLE 2.5.1.1-9 Deer Roadkill data analyzed using Chi-Square Test

Ho: Deer roadkill data does not vary from year to year.

Ha: Deer roadkill data is variable from year to year.

Class	X^2	Null Hypothesis ($X^2_{0.05,4}=9.488$)
Does	61.46	Reject
Fawns	45.1	Reject
Bucks	9.0	Accept
Unknown	3.0	Accept
Total Kill	80.94	Reject

D:26

TABLE 2.5.1.1-10

Piceance Creek Road Kill
(Piceance Creek Road from Mile 0 thru Mile 41)

Date	Does		Fawns				Bucks		Unknown	TOTAL
			Male		Female					
	No.	%	No.	%	No.	%	No.	%		
9-81 to 5-82	30	56	3	6	12	22	6	12	3	54
9-80 to 5-81	12	43	3	11	6	22	2	7	5	28
9-79 to 5-80	40	41	22	22	26	27	3	3	5	96
9-78 to 5-79	80	61	13	10	27	21	11	8	0	131
9-77 to 5-78	40	41	28	29	22	22	8	8	2	100*

* Total road kill was 125 deer. This figure was derived from combining DOW data with C-b data.

TABLE 2.5.1.1-11

Results of deer mortality studies.

Year	Sampling Location	No. of carcasses found	Hectares sampled (acres)	Carcasses per hectare (acre)
1974-75	Lateral draws	11	7.25 (18)	1.5 (0.6)
1975-76	Lateral draws	8	7.25 (18)	1.1 (0.4)
1976-77	Interim monitoring period - No sampling			
1977-78	Sagebrush lateral draw	25	70.5 (174)	0.4 (0.1)
1978-79	Sagebrush-lateral draw	34	70.5 (174)	0.5 (0.2)
1979-80	Sagebrush-lateral draw	60	70.5 (174)	0.9 (0.3)
1980-81	Sagebrush-lateral draw	16	70.5 (174)	0.2 (0.1)
1981-82	Sagebrush-lateral draw	2	70.5 (174)	0.03 (0.01)

TABLE 2.5.1.1-12

Age Class Composition of Mule Deer Wintering Near Tract C-b.

Date	Fawns	Does	Bucks	Adults	Fawns/ 100 Does	Bucks/ 100 Does	Fawns/ 100 Adults
1977 Nov. 15-23	85	107	28	135	79.4	26.2	63.0
1978 Apr. 4-7	68			104			65.0
1978 Nov. 13-27	151	159	35	194	95.0	22.0	77.8
1979 Apr. 20-26	41			343			12.0
1979 Nov. 27-Dec. 7	46	62	8	70	74.1	12.9	65.7
1980 Apr. 21-24	26			375			6.9
1980 November	No Count						
1981 Apr. 25	24			68			35.2
1981 Nov. 30-Dec. 4	27	31	2	33	87.1	6.5	81.8
1982 April 13-14	204			334			61.1

2.5.1.1.7 Interrelationships of Mule Deer Studies

Two topics will be considered in the following discussion: 1) a comparison of the variability found in estimates of deer pellet-group densities and the three browse measurements--percent utilization, hedging, and production; and 2) a preliminary examination of multivariate approaches to interpretation that incorporate both the pellet-group and the browse measurements.

Of central importance to monitoring is the ability to detect important changes, and to do so with some degree of statistical confidence. Consequently, it is desirable to single out indicator variables that have relatively little within-group variability, or error variance. Differences between groups (between areas or between time periods) can be more readily detected if within-group differences are small. A convenient way of comparing the amount of variability amoung different measurements is by comparing coefficients of variation, CV, (where CV = SD/X, expressed as a percent). The CV standardizes different scales of measurement permitting direct comparisons of variability regardless of the measurement units used. The bigger the CV, the greater the variability.

Table 2.5.1.1-13 shows coefficients of variation for four measurements: pellet-group counts, percent utilization of bitterbrush, hedging of bitterbrush, and bitterbrush production. The CV's for the browse measurements were obtained from bitterbrush shrubs within or near the same quadrats that were used for pellet-group counts. All measurements were obtained this past year. It is readily apparent upon examination of the table that percent utilization is least variable of all four measurements. Pellet-group counts are the most variable. It should also be mentioned that pellet-group counts are based on n = 20 (20 quadrats per transect), whereas browse measurements are based on n = 10 (10 shrubs per transect). Thus, pellet-group data would have even higher CVs if sample sizes were halved. These findings suggest that percent utilization is the single best variable to use for detecting differences in deer numbers. However, as discussed below, analyzing all available data is nonetheless considered the best procedure.

Optimizing time and effort devoted to sampling shrubs were evaluated during the early stages of the monitoring program, in 1975-76. It seems worthwhile to reevaluate sampling efficiency occasionally, however, because of the time required to conduct the shrub field studies. This is done below by an examination of the distribution of variance encountered over the heirarchial levels of the cluster sampling design. Measurements are current annual shoot growth of bitterbrush obtained this past year (i.e., production estimates of 1982).

3-LEVEL NESTED ANOVA:

Source of Variation	Components of Variance	DF
Between chained and pinyon-juniper habitat	5.6%	1
Among transects	2.6%	8
Among shrubs	23.0%	90
Among shoots	68.8%	900

TABLE 2.5.1.1-13 A comparison of the relative variability among pellet-group[1] and bitterbrush[2] measurements.

	COEFFICIENTS OF VARIATION (=SD/$\overline{X}$ x 100)			
Transects	Pellet-group counts	Percent utilization	Hedging[3]	Production[4]
CHAINED RANGELAND:				
BA17	91.6	6.9	71.8	40.1
BA18	68.5	11.6	64.8	31.5
BA25	55.8	16.9	70.1	45.3
BA01	56.1	12.6	54.3	43.6
BA06	146.5	10.4	49.7	39.8
BA09	189.2	21.4	41.0	32.5
BA30	90.3	6.4	62.8	12.9
BA31	55.5	6.7	58.3	28.1
BA32	50.6	9.2	41.6	40.1
BA20	61.1	7.1	59.8	19.6
BA21	66.4	10.9	70.4	43.0
BA23	91.0	3.8	71.8	54.8
Mean:	85.2	10.3	64.9	35.9
PINYON-JUNIPER:				
BA19	93.5	11.1	69.0	39.5
BA26	115.7	15.0	103.0	28.4
BA27	105.8	14.5	73.3	20.2
BA16	107.5	10.7	31.9	23.0
BA22	82.7	13.3	77.3	31.5
BA24	141.2	23.8	43.0	34.3
Mean:	107.7	14.7	66.3	29.5

[1] n = 20, 20 quadrats per transect

[2] n = 10, 10 shrubs per transect

[3] length of current annual growth after winter browsing

[4] length of current annual growth

It is evident that shoot measurements are most variable (accounting for 68.8 percent of the total variance). Shrub-to-shrub variability accounts for 23 percent. Relatively little variability occurs among transects. The difference between habitats, although rather small, is statistically significant ($F=6.01$, $P=.04$), the chained habitat being the most productive. Since the greatest variation is among shoots there is some argument for increasing the number of shoots measured on each shrub, but this is not recommended because of the additional labor required for these measurements.

Although browse measurements are not as variable as pellet-group counts (on Tract C-b at least), pellet-group counts require comparatively little effort and thereby permit more area to be sampled given the same amount of time. Furthermore, both data sets provide information on mule deer abundance and distribution, and consequently, both should be considered valuable in themselves as separate indicator variables. The lack of strong within-year correlations between pellet-group counts and percent utilization was pointed out in last year's report. The correlation this past year was again low ($r=0.01$). These results are interpreted as meaning only that at the spatial scale of this study (specifically, the transect size to habitat patch size relationship) the two data sets are not in agreement (browsing and defacation do not necessarily occur at the same spot). This weak correlation might be an advantage, however, in a multivariate statistical approach, at least for certain combinations of variables. One exploratory examination of the predictive power of combining variables was undertaken this past year. Using percent utilization as the dependent variable, pellet-group data and bitterbrush production data were used together as independent variables in a multiple regression model to see if both, in linear combination, would better explain the variance associated with percent utilization than either variable considered alone. But the multiple correlation coefficient was very low ($r=0.02$). Thus, there was almost no increase in predictive power with this combination of variables. Another possibility, however, would be to combine pellet-group and percent utilization data in a multivariate analysis of variance (MANOVA) model. This will be pursued in the future particularly in situations where mitigation or impact areas are to be compared with control areas.

MEDIUM-SIZED MAMMALS

2.5.1.2 Medium-sized Mammals

2.5.1.2.1 Coyote Scent Post Surveys

These surveys were discontinued during Interim Monitoring.

2.5.1.2.2 Lagomorph Abundance

Lagomorph pellet census is used to estimate lagomorph abundance. The 39 transects established for deer pellet studies are also used to collect lagomorph pellet data. Each transect consists of 20 - 0.001 acre plots (see Figure 2.5-1 for locations of transects). Transects are located in chained-rangeland, pinyon-juniper woodland and brush-beaten sage areas. Results of the summer 1982 pellet group census for both cottontails and jackrabbits are shown in Table 2.5.1.2-1.

A preliminary examination of cottontail population trends was performed this year by reviewing the data available since 1978-79. Prior to this date, methods were somewhat different and results are not valid for comparisons. A summary of cottontail results since 1978-79 is shown in Table 2.5.1.2-2. As can be seen upon examination of the table no definite trends are evident for the 4-year period. The low values for the brush-beaten sagebrush plots, however, suggest real differences between these treatment-control sites. Control plots in unmodified sagebrush have considerably higher values for the past two years. Differences for both 1980-81 and 1981-82 are significant ($t=2.46$, $df=7$, $P=0.04$; and $t=2.65$, $df=7$, $P=0.03$, respectively). The effects of brush-beating on cottontail populations will continue to be evaluated in future years. Presently it seems premature to attempt definitive conclusions regarding the seemingly negative effects of brush-beating on cottontail populations.

TABLE 2.5.1.2-1

Relative abundance of cottontails and jackrabbits, 1981-82. Each transect consists of twenty 0.001 acre plots.

	NUMBER OF PLOTS WITH LAGOMORPH DROPPINGS	
Transects	Cottontails	Jackrabbits
CHAINED RANGELAND:		
BA01	4	0
BA02	5	0
BA03	9	0
BA04	5	0
BA05	6	0
BA06	15	0
BA07	7	0
BA08	10	0
BA09	10	0
BA17	11	0
BA18	0	0
BA20	0	0
BA21	8	0
BA23	3	0
BA25	13	0
BA30	10	0
BA31	6	0
BA32	8	0
PINYON-JUNIPER:		
BA10	10	0
BA11	9	0
BA12	13	0
BA13	19	0
BA14	6	0
BA15	4	0
BA16	8	0
BA19	12	3
BA22	8	0
BA24	7	0
BA26	18	0
BA27	15	0
BRUSH-BEATEN SAGE:		
BA41	1	0
BA42	2	0
BA43	10	0
BA44	7	0
BA45	0	0
BA46	1	0
BA47	0	0
BA48	14	0
BA49	15	0

TABLE 2.5.1.2-2 Summary of results of cottontail trends. Data shown are means (number of quadrats with cottontail droppings present/total number of quadrats) +/- SE (n); n = number of transects (which consist of 20, 0.001 acre, quadrats).

	HABITAT			
Year	Chained rangeland	Pinyon-juniper	Brush-beaten sagebrush	Sagebrush control
1978-79	8+/-1.2 (18)	11+/-1.6 (12)	-	-
1979-80	12+/-0.9 (15)	11+/-1.3 (12)	-	-
1980-81	9+/-0.7 (18)	13+/-0.8 (12)	3+/-0.9 (4)	12+/-3.1 (5)
1981-82	7+/-1.0 (18)	11+/-1.4 (12)	1+/-0.4 (4)	9+/-2.7 (5)

SMALL
MAMMALS

2.5.1.3 Small Mammals

Objectives of small mammal studies during 1982 were: 1) to evaluate the spatial variability of small mammal populations, and from these findings predict the magnitude of a population decline needed for detection; and 2) to evaluate certain habitat features within the chained rangeland habitat as predictors of small mammal abundance.

2.5.1.3.1 Experimental Design

Methods for evaluating spatial variability were as follows: Ten locations were randomly chosen, each in a different but contiguous square-mile section. All sampling occurred in chained rangeland habitat and was restricted to ridge tops and adjacent convex slopes; valleys were avoided because of the different vegetation type. Four transects of livetraps were positioned at each location the first day using a systematic random design (the first location of regularly spaced transects was a random choice.) Transects were parallel, 10m apart, and consisted of ten traps spaced at 10m intervals.

Each set of four transects was moved ahead 10m each day for six days. Each location, therefore, received a 240 trap-night effort (or n=24, since each transect of ten traps represents one sample).

Methods for evaluating habitat features and their importance to small mammals were as follows: At all 240 transects (24 per location x 10 locations) measurements were obtained on eight characteristics that were considered likely to be important small mammal habitat components. These are listed below along with the measurement scale used.

Habitat Features	Measurement Scale
Amount of deadfall (large limbs and stumps)	1 - 5
Amount of loose rock (rocks > 6 inches)	1 - 5
Amount of grass-forb cover	1 - 5
Cover by sagebrush	1 - 5
Cover by bitterbrush	1 - 5
Cover by conifer	1 - 5
Aspect: east facing	East
Aspect: west facing	West

Measurements were made by one individual. All measurements pertain to a $1000m^2$ area (the transect length times 5m to either side of transect).

2.5.1.3.2 Method of Analysis

A 2-level nested analysis of variance (ANOVA) and a least significant difference (LSD) test were used for evaluating spatial variability and predicting the magnitude of a population decline needed for detection. A multiple regression model was used to evaluate habitat features as predictions of small mammal abundance.

2.5.1.3.3 Discussion and Results

Two species were captured frequently enough to permit analysis of spatial variability, the deer mouse and least chipmunk. ANOVA results and calculations of LSD for the deer mouse data are shown in Table 2.5.1.3-1. A very low percent of the total variance occurred among locations and among days for both species (0.1% and 4.6% for deer mice, and 1.2% and 8.5% for least chipmunks, respectively), indicating that both deer mice and least chipmunks were about equally abundant throughout the habitat and that day-to-day differences in activity patterns were minimal. For both species over 90% of the variance occurred among transects.

To predict the change in abundance needed for detection, a hypothetical sampling device was considered in which an identical trapping effort took place in a nearby impact area of the same habitat type. An LSD was calculated (Table 2.5.1.3-1) to find the least significant difference necessary for recognizing the two areas (impact area and control area) as being different in abundance levels. Based on this approach it was found that an impact suppressing deer mice and least chipmunk populations by 2.3% and 7.4% respectively would be detected at the 95% level. Capture data obtained during this study are shown in Table 2.5.1.3-2.

To evaluate the eight selected habitat features as predictors of small mammal abundance, deer mice and least chipmunk capture results were used as dependent variables in separate multiple regression analyses. Results demonstrated that none of the habitat features measured were correlated with capture frequencies (Table 2.5.1.3-3 and -4). Furthermore, standardized coefficients (beta weights) and the overall measure of association, the coefficient of determination (R^2), suggest that there is no predictive power using the combination of habitat variables chosen. These results are probably a reflection of the homogeneity of the habitat stratum within which sampling occurred. There simply is not much range of variation for any of the eight variables.

It is likely, for example, that deadfall and loose rock would have been singled out as important if a number of the sampling locations had been in areas totally devoid of these habitat features.

TABLE 2.5.1.3-1 Evaluation of spatial and temporal variation in a deer mouse population. Calculations below the ANOVA table illustrate a means of approximating the magnitude of a hypothetical impact required for detection based on these results.

TWO-LEVEL NESTED ANALYSIS OF VARIANCE:

Source of Variation	DF	MS	F	Variance Components
Among Locations	9	1.465	1.05	0.003 (0.1%)
Among Days	50	1.400	0.80	0.089 (4.6%)
Error	180	1.756		(95.3%)

$F_{(.05),\ df=9,50} = 2.07$ $F_{(.05),\ df=50,180} = 1.42$

Grand Mean of control area = 2.11 (the mean number of captures per location, pooled for 10 locations; capture success, therefore = 21.1%).

$$LSD = t_{\alpha(df)} \sqrt{2\ (\text{location variance}/n)}$$

where

LSD = Least Significant Difference (Sokal & Rohlf 1981),

α = .05, the selected probability level,

df = degrees of freedom (based on 480 transects, 240 in both control and hypothetical impact areas),

n = 10 locations, the sample size in control and impact areas.

thus

$$LSD = 1.965 \sqrt{2\ (.003)/10} = .048$$

Therefore, if a Grand Mean from a hypothetical impact area (with the same variance) lies outside the range of 2.11 +/- 0.048 (e.g., a population decline of 2.3%) it would be judged significantly different from the control area Grand Mean at the 95% level.

TABLE 2.5.1.3-2

Relative abundance of small mammals, 1982.[1] Actual number of animals captured is shown in brackets. Trapping locations were randomly chosen in chained rangeland habitat; 240 trap-nights[2] occurred at each of the ten locations.

Species	LOCATION NUMBERS 1	6	7	8	11	12	13	14	17	18
Deer Mouse *Peromyscus maniculatus*	19.2 {46}	20.0 {48}	17.5 {42}	18.3 {44}	22.5 {54}	20.4 {49}	22.1 {53}	25.4 {61}	23.8 {57}	21.7 {52}
Least Chipmunk *Eutamias minimus*	13.3 {32}	16.3 {39}	18.8 {45}	18.8 {45}	14.6 {35}	14.6 {35}	16.7 {40}	9.6 {23}	19.2 {46}	14.6 {35}
Golden-mantled Ground Squirrel *Spermophilus lateralis*	2.5 {6}	1.3 {3}	0.8 {2}	0.8 {2}		0.8 {2}	0.8 {2}			0.8 {2}
Bushy-tailed Woodrat *Neotoma cinerea*			0.4 {1}							
Apache Pocket Mouse *Perognathus apache*						0.4 {1}				

1 Relative abundance = number of captures ÷ number of trap-nights x 100.

2 A trap-night is one trap set one night.

TABLE 2.5.1.3-3 Relationships of eight habitat features and abundance of deer mice in chained rangeland habitat. Data are from a multiple regression analysis. Abundance of deer mice is the dependent variable.

Variables		Correlation matrix[1]									Beta weights[2]
		Pm	DF	LR	GF	S	B	C	E	W	
Abundance of deer mice	(Pm)	1									
Amount of deadfall	(DF)	-.01	1								-.01
Amount of loose rock	(LR)	.01	-.03	1							-.03
Cover by grass-forb	(GF)	-.04	.03	-.11	1						-.05
Cover by sagebrush	(S)	-.04	.07	-.05	-.07	1					-.03
Cover by bitterbrush	(B)	.06	.17	.15	-.06	-.40	1				.05
Cover by conifer	(C)	.11	-.16	.07	-.05	-.07	.08	1			.12
East-facing slope	(E)	-.05	-.14	-.14	-.14	-.17	.06	.23	1		-.11
West-facing slope	(W)	.02	.13	.25	.01	.24	-.10	-.04	-.50	1	-.01

The coefficient of determination[3] $R^2 = .02$ ($F = .74$, $df = 8,231$, $P = .66$)

1 The correlation matrix shows the separate bivariate correlations (absolute values >.14 are significant at $\alpha = .05$).

2 Beta weights are standard partial regression coefficients. They express the relative importance of the variable after partialing out the effects of the other variables.

3 The coefficient of determination, R^2, is an expression of the proportion of the total variability in the capture data attributable to the eight habitat variables. In this case only 2% ($R^2 = .02$) of the variability is explained by the multiple regression.

TABLE 2.5.1.3-4 Relationship of eight habitat features and abundance of least chipmunks in chained rangeland habitat. Data are from a multiple regression analysis. Abundance of least chipmunks is the dependent variable.

Variables		Correlation matrix[1]									Beta weights[2]
		Em	DF	LR	GF	S	B	C	E	W	
Abundance of chipmunks	(Em)	1									
Amount of deadfall	(DF)	-.03	1								-.01
Amount of loose rock	(LR)	.10	-.03	1							.12
Cover by grass-forb	(GF)	.01	.03	-.11	1						.02
Cover by sagebrush	(S)	-.01	.07	-.05	-.07	1					.01
Cover by bitterbrush	(B)	-.03	.17	.15	-.06	-.40	1				-.05
Cover by conifer	(C)	.04	-.16	.07	-.05	-.07	.08	1			.03
East-facing slope	(E)	.04	-.14	-.14	-.14	-.17	.06	.23	1		.04
West-facing slope	(W)	-.02	.13	.25	.01	.24	-.10	-.04	-.50	1	-.04

The coefficient of determination[3] $R^2 = .02$ ($F = .51$, $df = 8,231$, $P = .85$)

1 The correlation matrix shows the separate bivariate correlations (absolute values >.14 are significant at $\alpha = .05$).

2 Beta weights are standard partial regression coefficients. They express the relative importance of the variable after partialing out the effects of the other variables.

3 The coefficient of determination, R^2, is an expression of the proportion of the total variability in the capture data attributable to the eight habitat variables. In this case only 2% ($R^2 = .02$) of the variability is explained by the multiple regression.

2.5.1.4 Avifauna

2.5.1.4.1 Avifauna

No avifauna studies were conducted during the Interim Monitoring Period.

2.5.1.4.2 Raptor Activity

Raptor nesting data for 1976 through 1982 are listed in Table 2.5.1.4-1. The April census showed nine active nests. The June census showed six active nests having young birds present. Two nests were occupied by golden eagles, two by red-tailed hawks and two-by great-horned owls.

Our raptor population seems to be fairly stable in the study area. The population consisted mostly of red-tailed hawks, kestrels and great-horned owls during the summer while marsh, red-tailed, and rough legged hawks made up the majority of the winter population.

In addition to the nesting raptors, other raptors observed in the study area included: American kestrels, turkey vultures, sharp-shinned hawks, marsh hawks, night hawks, and bald eagles.

TABLE 2.5.1.4-1

RAPTOR NESTING RECORD

st No.	Species	Status 1976 April	Status 1976 June	Status 1977 April	Status 1977 June	Status 1978 April	Status 1978 June	Status 1979 April	Status 1979 June	Status 1980 April	Status 1980 June	Status 1981 April	Status 1981 June	Status 1982 April	Status 1982 June
1	Unknown	I		I	I	I	I	I	I	I	I	I	I	1	1
2	Unknown	I		I	I	I	I	I	I	I	I	I	I	1	1
3	Unknown	I		I	I	I	I	I	I	I	I	Nest Gone			
4	Red-tailed Hawk	E or Y		I	I	I	I	I	I	I	I	I	I	I	I
5	Unknown	I		I	I	I	I	I	I	I	I	I	I	I	I
5a	Common Raven	-		-	E or Y	I	I	I	I	I	I	A	I	I	I
6	Golden Eagle	E		I	2Y	I	I	E or Y	I	1Y	1Y	E	I	I	I
7	Red-tailed Hawk	I		I	-	E	I	E or Y	I	E or Y	1Y	E	2Y	I	I
8	Red-tailed Hawk	4Y		I	I	E	I	E or Y	I	I	I	I	I	I	I
9	Common Raven	I		I	I	I	I	I	I	E	2Y	I	I	I	I
10	Red-tailed Hawk	I		I	I	I	I	I	I	I	I	I	I	I	I
11	Nest Gone														
12	Red-tailed Hawk	I		I	I	E	1Y	I	I	I	I	I	I	I	I
13	Red-tailed Hawk	I		I	I	I	I	E or Y	I	I	I	I	I	I	I
14	Unknown	I		I	I	I	I	I	I	I	I	I	I	A	I
15	Unknown	I		I	I	I	I	I	I	I	I	I	I	I	I
16	Great Horned Owl	I		I	I	E	2Y	I	I	I	I	I	I	I	I
17	Great Horned Owl	I		I	I	I	I	I	I	I	I	I	I	I	I
18	Red-tailed Hawk	I		I	I	I	I	1Y	I(GHO)	I	I	I	I	I	I
19	Great Horned Owl	1Y		I	I	I	I	I	I	I	I	I	I	I	I
20	Unknown							I	I	Packrats					
21	Not on map														
22	Red-tailed Hawk	I		I	I	I	I	E or Y	I	I	2Y	A	I	E	1Y?
23	Not on map														
24	Red-tailed Hawk	I		I	I	I	I	I	I	Packrats		E	(?)Y	I	I
25	Great Horned Owl	I		I	I	I	I	I	I	Packrats					
26	Unknown	I		I	I	I	I			Nest Gone					
27	Red-tailed Hawk	I		I	I	I	I	E or Y	I	I	I	E	1Y	E	1Y
28	Golden Eagle	1Y		I	I	I	I	I	I	I	I	I	I	I	I
29	Unknown	I		I	I	I	I	I	I	I	I	I	I	I	I
30	Red-tailed Hawk	2Y		I	I	I	I	I	I	I	I	I	I	I	I
31	Unknown	I		I	I	I	I	I	I	I	2Y(RTH)	I	I	I	I
32	Great Horned Owl	2Y		2Y	-	I	I	I	I	I	I	I	2Y(RTH)	I	I
33	Unknown	I		I	I	I	I	I	I	I	I	I	2Y(RTH)	A	I
34	Unknown	I		I	I	I	I	I	I	I	I	I	I	A	I
35	Unknown	I		I	I	I	I	I	I	I	I	I	I	E(GHO)Y?	
36	Red-tailed Hawk	2Y		I	I	I	I	E	2Y	I	I	I	I	I	I
37	Unknown	I		I	I	I	I	I	I	I	I	I	I	I	I
38	Raven	I		I	I	I	I	E or Y	Y	I	E or Y	A	A	I	I
39	Golden Eagle	1Y		I	I	I	I	I	I	I	I	I	I	E	1Y
40	Great Horned Owl	I		I	I	E	2Y	2Y	I	I	I	I	I	I	I
41	Unknown	I		I	I	I	I			Nest Gone				I	I
42	Unknown	I		I	I	I	I	I	I	I	I	I	I	I	I
42a	Red-tailed Hawk	-		-	2Y	I	I	E or Y	I(GHO)	I	I	I	I	I	I
43	Great Horned Owl	2Y		I	I	I	I	I	I	I	I	I	I	I	I
44	Unknown	I		I	I	I	I	I	I	I	I	I	I	I	I
45	Red-tailed Hawk	2Y		I	I	I	I	E	2Y	I	2Y	I	I	I	I
46	Red-tailed Hawk					E	I	E or Y	I	I	I	I	I	I	I
47	Unknown					I	I	I	I	I	I	I	I	I	I
48	Great Horned Owl							E	I	I	I	E(RTH)	1Y	E	Y?
49	Magpie							E	I	I	I	I	I	I	I
50	Red-tailed Hawk									I	I	I	I	I	I
51	Golden Eagle									I	1Y	I	I	E	1Y
52	Red-tailed Hawk									I	I	I	1Y	I	I
	TOTAL ACTIVE NESTS	11		4		6		15		8		8		6	

Code:

I = inactive nest
A = signs of activity (ex. fresh boughs, bird near nest)
E = adult bird observed in an incubating posture; presumed to be incubating eggs.
(2) Y = number of young observed in the nest.
E or Y = adult bird observed in an incubating posture; due to time of year, assumed to be either incubating eggs or brooding very young chicks.

AQUATIC STUDIES

2.5.2 Aquatic Studies

2.5.2.1 Introduction

Aquatic sampling was conducted from May 1982 through November 1982.

2.5.2.2 Scope of Work

Aquatic studies consisted of periphyton and benthos sampling.

2.5.2.3 Benthos

2.5.2.3.1 Methods of Benthos Sampling and Analyses

Benthic macroinvertebrate sampling stations located in Piceance Creek (Figure 2.5.2-1) are the same as the current periphyton collection stations. Six collections were obtained at approximately one month intervals between May and October, 1982. CB staff biologists used a standard Surber sampler to provide three replicates from each station per sampling date. Each replicate was placed in a labeled container, preserved with 10% formalin on site, and mailed to Mariah Associates' Aquatics Laboratory in Laramie, Wyoming for further processing and analysis.

Upon arrival, the samples are washed over a fine mesh sieve (U.S. No. 60). Organisms are separated from debris and placed in vials of 80% ethyl alcohol. Identification and enumeration are accomplished with the aid of a Bausch and Lomb Stereo Zoom 7 (5x-210x) dissecting microscope. Whole oligochaete and chironomid head capsules are mounted in Hoyers cleaning and mounting medium and identified with the use of a Wild Heerbrugg microscope at a magnification of 200x or 400x.

2.5.2.3.2 Results

Benthos data are presented in Tables 2.5.2-1 - 2.5.2.3 as species lists, density and diversity.

The macroinvertebrate community of Piceance Creek is generally low in number of species and reflects the harsh physical environment common to streams in the Piceance Basin of Colorado (Gray and Ward 1978). Thirty macroinvertebrate taxa were collected from Piceance Creek in 1982. Stewart Station exhibited the highest number of total taxa (25) throughout the year, although Middle Station recorded 24 taxa in 1982. Only 11 taxa were identified from Hunter Station. Diversity values were generally low and ranged from 0.03 at Middle Station on June 30 to 1.38 at Middle Station on October 4 (Table 2.5.2-4). Diversity and evenness indices were slightly higher in October and November at Stewart Station and Middle Station and in November at Hunter Station. Generally, diversity, evenness and number of taxa were higher at Stewart and Middle Stations than at Hunter Station throughout 1982.

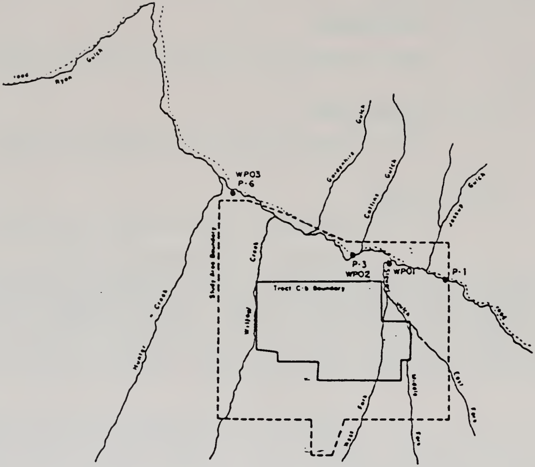


Figure 2.5.2-1

BENTHIC MACROINVERTEBRATE AND PERIPHYTON SAMPLING STATIONS

BENTHOS DATA

BENTHOS DATA

BENTHOS DENSITY AND SPECIES CALCULATIONS (Continued) | Page No.

TABLE 2.5.2-1

BENTHOS SPECIES LIST

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK
1982

TAXON	STATION NUMBER WP01	WP02	WP03
PHYLUM NEMATODA	X	X	X
PHYLUM ANNELIDA			
CLASS OLIGOCHAETA			
ORDER HAPLOTAXIDA			
FAMILY TUBIFICIDAE	X	X	X
FAMILY LUMBRICIDAE	X	X	
FAMILY NAIDIDAE	X	X	
CLASS HIRUDINEA			
ORDER RHYNCHOBDELLIDA			
FAMILY GLOSSIPHONIIDAE			
HELOBDELLA STAGNALIS	X	X	X
PHYLUM MOLLUSCA			
CLASS GASTROPODA			
ORDER BASSOMATOPHORA			
FAMILY PHYSIDAE			
PHYSA	X	X	X
CLASS BIVALVIA			
ORDER HETERODONTA			
FAMILY SPHAERIIDAE			
PISIDIUM	X		X
PHYLUM ARTHROPODA			
CLASS ARACHNIDA			
ORDER ACARINA	X	X	
CLASS INSECTA			
ORDER EPHEMEROPTERA			
FAMILY BAETIDAE	X		
BAETIS	X	X	
FAMILY EPHEMERELLIDAE			
EPHEMERELLA (EPHEMERELLA)	X	X	
FAMILY TRICORYTHIDAE			
TRICORYTHODES	X	X	X
ORDER TRICHOPTERA			
FAMILY HYDROPSYCHIDAE			
HYDROPSYCHE	X		
ORDER COLEOPTERA			
FAMILY ELMIDAE			
OPTIOSERVUS	X	X	
ZAITZEVIA PARVULA	X	X	
FAMILY HALIPLIDAE			
BRYCHIUS		X	X
FAMILY DYTISCIDAE			
AGABINUS		X	
ORDER DIPTERA			
FAMILY CERATOPOGONIDAE			
SUBFAMILY CERATOPOGONINAE	X	X	
FAMILY CHIRONOMIDAE		X	
SUBFAMILY TANYPODINAE	X	X	X
TRIBE PENTANEURINI		X	
TRIBE MACROPLEOPIINI		X	
SUBFAMILY ORTHOCLADIINAE			
TRIBES ORTHOCLADIINI AND METRIOCNE	X	X	X
SUBFAMILY CHIRONOMINAE			
TRIBE CHIRONOMINI	X	X	X

TRIBE TANYTARSINI	X	X	X
FAMILY EMPIDIDAE	X		
FAMILY TIPULIDAE	X	X	
HEXATOMA	X		
ORMOSIA	X		
TIPULA	X	X	

X = ORGANISM IDENTIFIED TO THIS TAXONOMIC LEVEL OBSERVED AT SAMPLING STATION

BENTHOS SPECIES LIST

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SPECIES OCCURRENCE BY SAMPLING DATE AT STATION WPO1
1982

TAXON	SAMPLING DATE MAY	JUNE	JULY	AUG	SEPT	OCT
PHYLUM NEMATODA	X	X	X		X	X
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	X	X	X	X	X	X
FAMILY LUMBRICIDAE					X	
FAMILY NAIDIDAE		X	X	X	X	X
CLASS HIRUDINEA						
ORDER RHYNCHOBDELLIDA						
FAMILY GLOSSIPHONIIDAE						
HELOBDELLA STAGNALIS		X			X	
PHYLUM MOLLUSCA						
CLASS GASTROPODA						
ORDER BASSOMATOPHORA						
FAMILY PHYSIDAE						
PHYSA			X	X		
CLASS BIVALVIA						
ORDER HETERODONTA						
FAMILY SPHAERIIDAE						
PISIDIUM			X			
PHYLUM ARTHROPODA						
CLASS ARACHNIDA						
ORDER ACARINA			X			
CLASS INSECTA						
ORDER EPHEMEROPTERA						
FAMILY BAETIDAE					X	
BAETIS	X				X	X
FAMILY EPHEMERELLIDAE						
EPHEMERELLA (EPHEMERELLA)	X					
FAMILY TRICORYTHIDAE						
TRICORYTHODES	X	X				
ORDER TRICHOPTERA						
FAMILY HYDROPSYCHIDAE						
HYDROPSYCHE	X					
ORDER COLEOPTERA						
FAMILY ELMIDAE						
OPTIOSERVUS		X	X			
ZAITZEVIA PARVULA						X
ORDER DIPTERA						
FAMILY CERATOPOGONIDAE						
SUBFAMILY CERATOPOGONINAE	X					
FAMILY CHIRONOMIDAE						
SUBFAMILY TANYPODINAE						X
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNE	X	X			X	X
SUBFAMILY CHIRONOMINAE						
TRIBE CHIRONOMINI	X					
TRIBE TANYTARSINI						X
FAMILY EMPIDIDAE						X
FAMILY TIPULIDAE					X	
HEXATOMA	X					

[illegible]			X		
TIPULA	X	X	X	X	

X = ORGANISM IDENTIFIED TO THIS TAXONOMIC LEVEL OBSERVED AT SAMPLING STATION

BENTHOS SPECIES LIST

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SPECIES OCCURRING BY SAMPLING DATE AT STATION WPO2
1982

TAXON	SAMPLING DATE MAY	JUNE	JULY	AUG	SEPT	OCT
PHYLUM NEMATODA	X	X	X	X	X	
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	X	X	X	X	X	X
FAMILY LUMBRICIDAE					X	X
FAMILY NAIDIDAE			X	X	X	X
CLASS HIRUDINEA						
ORDER RHYNCHOBDELLIDA						
FAMILY GLOSSIPHONIIDAE						
HELOBDELLA STAGNALIS				X		
PHYLUM MOLLUSCA						
CLASS GASTROPODA						
ORDER BASOMMATOPHORA						
FAMILY PHYSIDAE						
PHYSA			X	X		X
PHYLUM ARTHROPODA						
CLASS ARACHNIDA						
ORDER ACARINA			X			
CLASS INSECTA						
ORDER EPHEMEROPTERA						
FAMILY BAETIDAE						
BAETIS	X				X	X
FAMILY EPHEMERELLIDAE						
EPHEMERELLA (EPHEMERELLA)	X					
FAMILY TRICORYTHIDAE						
TRICORYTHODES	X	X				
ORDER COLEOPTERA						
FAMILY ELMIDAE						
OPTIOSERVUS		X	X			
ZAITZEVIA PARVULA					X	
FAMILY HALIPLIDAE						
BRYCHIUS					X	
FAMILY DYTISCIDAE						
AGABINUS	X					
ORDER DIPTERA						
FAMILY CERATOPOGONIDAE						
SUBFAMILY CERATOPOGONINAE	X	X	X			
FAMILY CHIRONOMIDAE					X	
SUBFAMILY TANYPODINAE					X	
TRIBE PENTANEURINI	X					
TRIBE MACROPELOPIINI	X		X			
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNE	X				X	X
SUBFAMILY CHIRONOMINAE						
TRIBE CHIRONOMINI	X					
TRIBE TANYTARSINI	X					X
FAMILY TIPULIDAE					X	
TIPULA	X				X	X

X = ORGANISM IDENTIFIED TO THIS TAXONOMIC LEVEL OBSERVED AT SAMPLING STATION

BENTHOS SPECIES LIST

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SPECIES OCCURRENCE BY SAMPLING DATE AT STATION WP03
1982

TAXON	SAMPLING DATE MAY	JUNE	JULY	AUG	SEPT	OCT
PHYLUM NEMATODA		X			X	
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	X	X		X	X	X
CLASS HIRUDINEA						
ORDER RHYNCHOBDELLIDA						
FAMILY GLOSSIPHONIIDAE						
HELOBDELLA STAGNALIS				X		
PHYLUM MOLLUSCA						
CLASS GASTROPODA						
ORDER BASOMMATOPHORA						
FAMILY PHYSIDAE						
PHYSA				X		X
CLASS BIVALVIA						
ORDER HETERODONTA						
FAMILY SPHAERIIDAE						
PISIDIUM			X	X		X
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER EPHEMEROPTERA						
FAMILY TRICORYTHIDAE						
TRICORYTHODES	X	X				
ORDER COLEOPTERA						
FAMILY HALIPLIDAE						
BRYCHIUS					X	
ORDER DIPTERA						
FAMILY CHIRONOMIDAE						
SUBFAMILY TANYPODINAE					X	
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNE	X	X		X	X	X
SUBFAMILY CHIRONOMINAE						
TRIBE CHIRONOMINI	X					
TRIBE TANYTARSINI	X					

X = ORGANISM IDENTIFIED TO THIS TAXONOMIC LEVEL OBSERVED AT SAMPLING STATION

TABLE 2.5.2-2

BENTHOS DATA SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE SITE: WP01 - STEWART

SAMPLE DATE - 06-01-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
TIPA	TIPULA	4	4	0
BAET	BAETIS	24	4	4
NEMA	PHYLUM NEMATODA	16	4	44
CERE	SUBFAMILY CERATOPOGONINAE	16	4	16
TUBY	FAMILY TUBIFICIDAE	364	64	188
TROM	TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	16	12	56
TRIC	TRICORYTHODES	0	0	4
TIPS	HEXATOMA	0	0	4
EPEP	EPHEMERELLA (EPHEMERELLA)	0	0	4
CHIT	TRIBE CHIRONOMINI	0	0	4
HYSP	HYDROPSYCHE	0	0	4

SAMPLE SITE: WP02 - MIDDLE

SAMPLE DATE - 06-01-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
TANT	TRIBE TANYTARSINI	4	16	0
NEMA	PHYLUM NEMATODA	4	12	16
CHIT	TRIBE CHIRONOMINI	4	0	0
TUBY	FAMILY TUBIFICIDAE	152	1600	184
TROM	TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	12	36	20
TIPA	TIPULA	0	4	4
EPEP	EPHEMERELLA (EPHEMERELLA)	0	0	8
TRIC	TRICORYTHODES	0	0	4
BAET	BAETIS	0	0	4
CERE	SUBFAMILY CERATOPOGONINAE	0	0	8
PENT	TRIBE PENTANEURINI	0	0	4
AGBS	AGABINUS	0	0	4
MACR	TRIBE MACROPLEOPIINI	0	8	0

SAMPLE SITE: WP03 - HUNTER

SAMPLE DATE - 06-01-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
TUBY	FAMILY TUBIFICIDAE	88	264	772
TROM	TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	4	8	16
TANT	TRIBE TANYTARSINI	0	8	0
CHIT	TRIBE CHIRONOMINI	0	4	0
TRIC	TRICORYTHODES	0	0	8

BENTHUS DATA SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WPC1 - STEWART

SAMPLE DATE - 06-30-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
TIPA	TIPULA	8	0	0
TRIC	TRICORYTHODES	32	0	0
NEMA	PHYLUM NEMATODA	8	4	12
HEST	HELOBDELLA STAGNALIS	4	0	0
OPTI	OPTIOSERVUS	8	4	0
TUBY	FAMILY TUBIFICIDAE	216	152	196
NAID	FAMILY NAIDIDAE	4	0	0
TROM	TRIBES ORTHOCLADIINI AND METRIOCNEMINI	4	4	0

SAMPLE STATION: WPC2 - MIDDLE

SAMPLE DATE - 06-30-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
TUBY	FAMILY TUBIFICIDAE	2304	2656	160
NEMA	PHYLUM NEMATODA	4	4	0
TRIC	TRICORYTHODES	0	4	0
CERE	SUBFAMILY CERATOPOGONINAE	0	0	4
OPTI	OPTIOSERVUS	0	0	4

SAMPLE STATION: WPC3 - HUNTER

SAMPLE DATE - 06-30-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C

TRIC	TRICORYTHODES	24	4	12
NEMA	PHYLUM NEMATODA	12	4	12
TUBY	FAMILY TUBIFICIDAE	1264	916	395
TROM	TRIBES ORTHOCLADIINI AND METRIOCNEMINI	8	0	0

BENTHOS DATA SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART

SAMPLE DATE - 07-29-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
PHYS	PHYSA	0	16	8
OPTI	OPTIOSERVUS	0	8	0
ACAR	ORDER ACARINA	8	4	0
TUBY	FAMILY TUBIFICIDAE	528	1600	496
NEMA	PHYLUM NEMATODA	4	4	12
NAID	FAMILY NAIDIDAE	320	46	56
PISI	PISIDIUM	0	0	4

SAMPLE STATION: WP02 - MIDDLE

SAMPLE DATE - 07-29-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
TUBY	FAMILY TUBIFICIDAE	1488	2472	1488
NEMA	PHYLUM NEMATODA	24	8	0
PHYS	PHYSA	32	0	16
ACAR	ORDER ACARINA	4	12	0
OPTI	OPTIOSERVUS	4	8	4
CERE	SUBFAMILY CERATOPOGONINAE	4	0	4
MACR	TRIBE MACROPLEOPIINI	4	0	0
NAID	FAMILY NAIDIDAE	432	720	384

BENTHOS DATA SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART

SAMPLE DATE - 09-02-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
TUBY	FAMILY TUBIFICIDAE	94	64	44
PHYS	PHYSA	0	4	4
NAID	FAMILY NAIDIDAE	0	4	0

SAMPLE STATION: WP02 - MIDDLE

SAMPLE DATE - 09-02-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
PHYS	PHYSA	8	0	0
HEST	HELOBDELLA STAGNALIS	4	0	0
TUBY	FAMILY TUBIFICIDAE	54	4	4
NAID	FAMILY NAIDIDAE	4	4	4
NEMA	PHYLUM NEMATODA	0	0	4

SAMPLE STATION: WP03 - HUNTER

SAMPLE DATE - 09-02-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
TUBY	FAMILY TUBIFICIDAE	1552	624	336
PHYS	PHYSA	4	8	36
HEST	HELOBDELLA STAGNALIS	0	4	0
TROM	TRIBES ORTHOCLADIINI AND METRIOCNEMINI	0	0	4

BENTHOS DATA SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WPO1 - STEWART

SAMPLE DATE - 10-04-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

		REPLICATE DESIGNATION		
CODE	TAXON	A	B	C
TUBY	FAMILY TUBIFICIDAE	140	96	36
NAID	FAMILY NAIDIDAE	8	8	0
BAET	BAETIS	8	4	8
TIPA	TIPULA	4	4	0
TROM	TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	4	4	4
TIPU	FAMILY TIPULIDAE	4	4	8
NEMA	PHYLUM NEMATODA	0	8	0
LUMB	FAMILY LUMBRICIDAE	0	4	0
ORMO	ORMOSIA	0	4	0
BATD	FAMILY BAETIDAE	0	4	0
HEST	HELOBOELLA STAGNALIS	0	4	0

SAMPLE STATION: WPO2 - MIDDLE

SAMPLE DATE - 10-04-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

		REPLICATE DESIGNATION		
CODE	TAXON	A	B	C
LUMB	FAMILY LUMBRICIDAE	8	0	0
TROM	TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	12	8	0
TIPA	TIPULA	8	4	4
BAET	BAETIS	4	0	0
ZAPA	ZAITZEVIA PARVULA	4	0	0
BRYC	BRYCHIUS	4	0	0
TANY	SUBFAMILY TANYPODINAE	12	0	0
TIPU	FAMILY TIPULIDAE	4	0	4
CHIF	FAMILY CHIRONOMIDAE	4	0	0
TUBY	FAMILY TUBIFICIDAE	32	40	100
NEMA	PHYLUM NEMATODA	0	0	4
NAID	FAMILY NAIDIDAE	0	0	4

SAMPLE STATION: WPO3 - HUNTER

SAMPLE DATE - 10-04-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
TUBY	FAMILY TUBIFICIDAE	1156	228	1548
TROM	TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	4	4	0
NEMA	PHYLUM NEMATODA	4	4	0
TANY	SUBFAMILY TANYPODINAE	0	4	0
BRYC	BRYCHIUS	0	0	4

BENTHOS DATA SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART

SAMPLE DATE - 11-03-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
TUBY	FAMILY TUBIFICIDAE	[illegible]	204	232
NEMA	PHYLUM NEMATODA	[illegible]	0	4
TANY	SUBFAMILY TANYPODINAE	[illegible]	0	4
TROM	TRIBES ORTHOCLADIINI AND METRIOCNEMINI	[illegible]	224	104
ZAPA	ZAITZEVIA PARVULA	4	4	0
TIPA	TIPULA	[illegible]	16	8
NAID	FAMILY NAIDIDAE	0	24	0
BAET	BAETIS	0	4	4
TANT	TRIBE TANYTARSINI	0	4	0
EMPP	FAMILY EMPIDIDAE	0	4	0

SAMPLE STATION: WP02 - MIDDLE

SAMPLE DATE - 11-03-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
TROM	TRIBES ORTHOCLADIINI AND METRIOCNEMINI	52	20	156
TUBY	FAMILY TUBIFICIDAE	12	20	32
NAID	FAMILY NAIDIDAE	0	4	4
TIPA	TIPULA	0	4	16
LUMB	FAMILY LUMBRICIDAE	0	4	4
PHYS	PHYSA	0	4	20
TANT	TRIBE TANYTARSINI	0	4	4
BAET	BAETIS	0	0	4

SAMPLE STATION: WP03 - HUNTER

SAMPLE DATE - 11-03-82
NUMBER OF REPLICATES - 3
SAMPLER SIZE - 929.0 CM2

CODE	TAXON	REPLICATE DESIGNATION A	B	C
TUBY	FAMILY TUBIFICIDAE	152	256	144
TROM	TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	4	0	16
PISI	PISIDIUM	4	0	0
PHYS	PHYSA	0	4	0

TABLE 2.5.2-3

BENTHOS (MACROINVERTEBRATES) DENSITY AND DIVERSITY CALCULATIONS

Table 2.5.2-3

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
NUMBER OF REPLICATES - 3
SAMPLE DATE - 06-01-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE
PHYLUM NEMATODA	172.2	43.1	473.6	229.6	221.0	7.4
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	3918.2	688.9	2023.7	2210.3	1622.7	71.6
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER EPHEMEROPTERA						
FAMILY BAETIDAE						
BAETIS	258.3	43.1	43.1	114.8	124.3	3.7
FAMILY EPHEMERELLIDAE						
EPHEMERELLA (EPHEMERELLA)	.0	.0	43.1	14.4	24.9	.5
FAMILY TRICORYTHIDAE						
TRICORYTHODES	.0	.0	43.1	14.4	24.9	.5
ORDER TRICHOPTERA						
FAMILY HYDROPSYCHIDAE						
HYDROPSYCHE	.0	.0	43.1	14.4	24.9	.5
ORDER DIPTERA						
FAMILY CERATOPOGONIDAE						
SUBFAMILY CERATOPOGONINAE	172.2	43.1	172.2	129.2	74.6	4.2
FAMILY CHIRONOMIDAE						
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	172.2	129.2	602.8	301.4	261.9	9.8
SUBFAMILY CHIRONOMINAE						
TRIBE CHIRONOMINI	.0	.0	43.1	14.4	24.9	.5
FAMILY TIPULIDAE						
HEXATOMA	.0	.0	43.1	14.4	24.9	.5
TIPULA	43.1	43.1	.0	28.7	24.9	.9
TOTAL	4736.3	990.3	3530.7	3085.8	1912.2	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - 1.083
VARIANCE - .0035
MAXIMUM INDEX - 2.398
EVENNESS - .452
NO OF TAXA - 11

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3

SAMPLE DATE - 05-01-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE
PHYLUM NEMATODA	43.1	129.2	172.2	114.8	65.8	1.5
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	1636.2	17222.8	1980.6	6946.5	8901.2	91.8
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER EPHEMEROPTERA						
FAMILY BAETIDAE						
BAETIS	.0	.0	43.1	14.4	24.9	.2
FAMILY EPHEMERELLIDAE						
EPHEMERELLA (EPHEMERELLA)	.0	.0	86.1	28.7	49.7	.4
FAMILY TRICORYTHIDAE						
TRICORYTHODES	.0	.0	43.1	14.4	24.9	.2
ORDER COLEOPTERA						
FAMILY DYTISCIDAE						
AGABINUS	.0	.0	43.1	14.4	24.9	.2
ORDER DIPTERA						
FAMILY CERATOPOGONIDAE						
SUBFAMILY CERATOPOGONINAE	.0	.0	86.1	28.7	49.7	.4
FAMILY CHIRONOMIDAE						
SUBFAMILY TANYPODINAE						
TRIBE PENTANEURINI	.0	.0	43.1	14.4	24.9	.2
TRIBE MACROPELOPIINI	.0	86.1	.0	28.7	49.7	.4
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	129.2	387.5	215.3	244.0	131.5	3.2
SUBFAMILY CHIRONOMINAE						
TRIBE CHIRONOMINI	43.1	.0	.0	14.4	24.9	.2
TRIBE TANYTARSINI	43.1	172.2	.0	71.8	89.6	.9
FAMILY TIPULIDAE						
TIPULA	.0	43.1	43.1	28.7	24.9	.4
TOTAL	1894.5	18040.9	2755.7	7563.7	9083.7	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - .441
VARIANCE - .0002
MAXIMUM INDEX - 2.565
EVENNESS - .172
NO OF TAXA - 13

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3
SAMPLE DATE - 06-01-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE

PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	947.3	2841.8	8310.0	4033.0	3823.2	95.9
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER EPHEMEROPTERA						
FAMILY TRICORYTHIDAE						
TRICORYTHODES	.0	.0	86.1	28.7	49.7	.7
ORDER DIPTERA						
FAMILY CHIRONOMIDAE						
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	43.1	86.1	172.2	100.5	65.8	2.4
SUBFAMILY CHIRONOMINAE						
TRIBE CHIRONOMINI	.0	43.1	.0	14.4	24.9	.3
TRIBE TANYTARSINI	.0	86.1	.0	28.7	49.7	.7
TOTAL	990.3	3057.1	8568.4	4205.2	3917.3	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - .217
VARIANCE - .0002
MAXIMUM INDEX - 1.609
EVENNESS - .135
NO OF TAXA - 5

BENTHOS (MACROINVERTEBRATES) DENSITY AND DIVERSITY CALCULATIONS

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
NUMBER OF REPLICATES - 3
SAMPLE DATE - 06-30-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE
PHYLUM NEMATODA	86.1	43.1	129.2	86.1	43.1	3.7
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	2325.1	1636.2	2109.8	2023.7	352.4	86.0
FAMILY NAIDIDAE	43.1	.0	.0	14.4	24.9	.6
CLASS HIRUDINEA						
ORDER RHYNCHOBDELLIDA						
FAMILY GLOSSIPHONIIDAE						
HELOBDELLA STAGNALIS	43.1	.0	.0	14.4	24.9	.6
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER EPHEMEROPTERA						
FAMILY TRICORYTHIDAE						
TRICORYTHODES	344.5	.0	.0	114.8	198.9	4.9
ORDER COLEOPTERA						
FAMILY ELMIDAE						
OPTIOSERVUS	86.1	43.1	.0	43.1	43.1	1.8
ORDER DIPTERA						
FAMILY CHIRONOMIDAE						
SUBFAMILY ORTHOCLADIINAE						
TRIBE ORTHOCLADIINI AND METRIOCNEMINI	43.1	43.1	.0	28.7	24.9	1.2
FAMILY TIPULIDAE						
TIPULA	86.1	.0	.0	28.7	49.7	1.2
TOTAL	3057.1	1765.3	2239.0	2353.8	653.5	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - .641
VARIANCE - .0007
MAXIMUM INDEX - 2.079
EVENNESS - .308
NO OF TAXA - 8

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3
SAMPLE DATE - 06-30-82

DENSITY(#/M2) PERCENT

TAXON	REP 1	REP 2	REP 3	MEAN	S.D.	RELATIVE ABUNDANCE
PHYLUM NEMATODA	43.1	43.1	.0	28.7	24.9	.2
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	24800.9	28589.9	1722.3	18371.0	14542.2	99.6
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER EPHEMEROPTERA						
FAMILY TRICORYTHIDAE						
TRICORYTHODES	.0	43.1	.0	14.4	24.9	.1
ORDER COLEOPTERA						
FAMILY ELMIDAE						
OPTIOSERVUS	.0	.0	43.1	14.4	24.9	.1
ORDER DIPTERA						
FAMILY CERATOPOGONIDAE						
SUBFAMILY CERATOPOGONINAE	.0	.0	43.1	14.4	24.9	.1
TOTAL	24843.9	28676.0	1808.4	18442.8	14532.7	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - .031
VARIANCE - .0000
MAXIMUM INDEX - 1.609
EVENNESS - .019
NO OF TAXA - 5

SAMPLE STATION: 4P03 - HUNTER
NUMBER OF REPLICATES - 3
SAMPLE DATE - 06-30-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE
PHYLUM NEMATODA	129.2	43.1	129.2	100.5	49.7	1.1
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	13606.0	9860.1	4251.9	9239.3	4707.9	97.1
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER EPHEMEROPTERA						
FAMILY TRICORYTHIDAE						
TRICORYTHODES	258.3	43.1	129.2	143.5	108.4	1.5
ORDER DIPTERA						
FAMILY CHIRONOMIDAE						
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNEMINI	86.1	.0	.0	28.7	49.7	.3
TOTAL	14079.7	9946.2	4510.2	9512.0	4799.5	100.0

DIVERSITY INDEX CALCULATIONS

```
SHANNON INDEX  -   .157
VARIANCE       -   .0001
MAXIMUM INDEX  -  1.386
EVENNESS       -   .113
NO OF TAXA     -      4
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ENTHOS (MACROINVERTEBRATES) DENSITY AND DIVERSITY CALCULATIONS

ATHEORAL BLUFFS SHALE OIL COMPANY
ICEANC' CREEK

AMPLE STATION: WP01 - STEWART
UMBER OF REPLICATES - 3
AMPLE DATE - 07-29-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE
HYLUM NEMATODA	43.1	43.1	129.2	71.8	49.7	.6
HYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	5683.5	17222.8	5339.1	9415.1	6763.8	84.2
FAMILY NAIDIDAE	3444.6	516.7	602.8	1521.3	1666.1	13.6
HYLUM MOLLUSCA						
CLASS GASTROPODA						
ORDER BASSOMATOPHORA						
FAMILY PHYSIDAE						
PHYSA	.0	172.2	86.1	86.1	86.1	.8
CLASS BIVALVIA						
ORDER HETERODONTA						
FAMILY SPHAERIIDAE						
PISIDIUM	.0	.0	43.1	14.4	24.9	.1
HYLUM ARTHROPODA						
CLASS ARACHNIDA						
ORDER ACARINA	86.1	43.1	.0	43.1	43.1	.4
CLASS INSECTA						
ORDER COLEOPTERA						
FAMILY ELMIDAE						
OPTIOSERVUS	.0	86.1	.0	28.7	49.7	.3
TOTAL	9257.3	18084.0	6200.2	11180.5	6170.9	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - .531
VARIANCE - .0001
MAXIMUM INDEX - 1.946
EVENNESS - .273
NO OF TAXA - 7

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3
SAMPLE DATE - 07-29-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE

PHYLUM NEMATODA	258.3	86.1	.0	114.8	131.5	.5
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	16017.2	26609.3	16017.2	19547.9	6115.3	76.6
FAMILY NAIDIDAE	4650.2	7750.3	4133.5	5511.3	1956.1	21.6
PHYLUM MOLLUSCA						
CLASS GASTROPODA						
ORDER BASSOMATOPHORA						
FAMILY PHYSIDAE						
PHYSA	344.5	.0	172.2	172.2	172.2	.7
PHYLUM ARTHROPODA						
CLASS ARACHNIDA						
ORDER ACARINA	43.1	129.2	.0	57.4	65.8	.2
CLASS INSECTA						
ORDER COLEOPTERA						
FAMILY ELMIDAE						
OPTIOSERVUS	43.1	86.1	43.1	57.4	24.9	.2
ORDER DIPTERA						
FAMILY CERATOPOGONIDAE						
SUBFAMILY CERATOPOGONINAE	43.1	.0	43.1	28.7	24.9	.1
FAMILY CHIRONOMIDAE						
SUBFAMILY TANYPODINAE						
TRIBE MACROPLEOPIINI	43.1	.0	.0	14.4	24.9	.1
TOTAL	21442.4	34660.9	20409.0	25504.1	7946.8	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - .632
VARIANCE - .0000
MAXIMUM INDEX - 2.079
EVENNESS - .304
NO OF TAXA - 8

BENTHOS (MACROINVERTEBRATES) DENSITY AND DIVERSITY CALCULATIONS

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
NUMBER OF REPLICATES - 3
SAMPLE DATE - 09-02-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	904.2	688.9	473.6	688.9	215.3	94.1
FAMILY NAIDIDAE	.0	43.1	.0	14.4	24.9	2.0
PHYLUM MOLLUSCA						
CLASS GASTROPODA						
ORDER BASOMMATOPHORA						
FAMILY PHYSIDAE						
PHYSA	.0	43.1	43.1	28.7	24.9	3.9
TOTAL	904.2	775.0	516.7	732.0	197.3	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - .251
VARIANCE - .0009
MAXIMUM INDEX - 1.099
EVENNESS - .236
NO OF TAXA - 3

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3
SAMPLE DATE - 09-02-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE
PHYLUM NEMATODA	.0	.0	43.1	14.4	24.9	4.0
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	688.9	43.1	43.1	258.3	372.9	72.0
FAMILY NAIDIDAE	43.1	43.1	43.1	43.1	.0	12.0
CLASS HIRUDINEA						
ORDER RHYNCHOBDELLIDA						
FAMILY GLOSSIPHONIIDAE						
HELOBDELLA STAGNALIS	43.1	.0	.0	14.4	24.9	4.0
PHYLUM MOLLUSCA						

CLASS GASTROPODA						
ORDER BASSOMATOPHORA						
FAMILY PHYSIDAE						
PHYSA	86.1	.0	.0	28.7	49.7	8.0
TOTAL	861.1	86.1	129.2	358.8	435.6	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - .951
VARIANCE - .0029
MAXIMUM INDEX - 1.609
EVENNESS - .591
NO OF TAXA - 5

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3
SAMPLE DATE - 09-02-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	16706.1	6716.9	3616.8	9013.3	6840.2	97.8
CLASS HIRUDINEA						
ORDER RHYNCHOBDELLIDA						
FAMILY GLOSSIPHONIIDAE						
HELOBDELLA STAGNALIS	.0	43.1	.0	14.4	24.9	.2
PHYLUM MOLLUSCA						
CLASS GASTROPODA						
ORDER BASSOMATOPHORA						
FAMILY PHYSIDAE						
PHYSA	43.1	86.1	387.5	172.2	187.7	1.9
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER DIPTERA						
FAMILY CHIRONOMIDAE						
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	.0	.0	43.1	14.4	24.9	.2
TOTAL	16749.2	6846.1	4047.4	9214.2	6673.8	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - .115
VARIANCE - .0000
MAXIMUM INDEX - 1.386
EVENNESS - .084
NO OF TAXA - 4

BENTHOS (MACROINVERTEBRATES) DENSITY AND DIVERSITY CALCULATIONS

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
NUMBER OF REPLICATES - 3
SAMPLE DATE - 10-04-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE
PHYLUM NEMATODA	.0	86.1	.0	28.7	49.7	2.2
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	1507.0	1033.4	387.5	976.0	561.9	73.9
FAMILY LUMBRICIDAE	.0	43.1	.0	14.4	24.9	1.1
FAMILY NAIDIDAE	86.1	86.1	.0	57.4	49.7	4.3
CLASS HIRUDINEA						
ORDER RHYNCHOBDELLIDA						
FAMILY GLOSSIPHONIIDAE						
HELOBDELLA STAGNALIS	.0	43.1	.0	14.4	24.9	1.1
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER EPHEMEROPTERA						
FAMILY BAETIDAE	.0	43.1	.0	14.4	24.9	1.1
BAETIS	86.1	43.1	86.1	71.8	24.9	5.4
ORDER DIPTERA						
FAMILY CHIRONOMIDAE						
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	43.1	43.1	43.1	43.1	.0	3.3
FAMILY TIPULIDAE	43.1	43.1	86.1	57.4	24.9	4.3
ORMOSIA	.0	43.1	.0	14.4	24.9	1.1
TIPULA	43.1	43.1	.0	28.7	24.9	2.2
TOTAL	1808.4	1550.1	602.8	1320.4	634.8	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - 1.129
VARIANCE - .0015
MAXIMUM INDEX - 2.398
EVENNESS - .471
NO OF TAXA - 11

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3
SAMPLE DATE - 10-04-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE

PHYLUM NEMATODA	.0	.0	43.1	14.4	24.9	1.5
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	344.5	430.6	1076.4	617.2	400.1	66.2
FAMILY LUMBRICIDAE	86.1	.0	.0	28.7	49.7	3.1
FAMILY NAIDIDAE	.0	.0	43.1	14.4	24.9	1.5
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER EPHEMEROPTERA						
FAMILY BAETIDAE						
BAETIS	43.1	.0	.0	14.4	24.9	1.5
ORDER COLEOPTERA						
FAMILY ELMIDAE						
ZAITZEVIA PARVULA	43.1	.0	.0	14.4	24.9	1.5
FAMILY HALIPLIDAE						
BRYCHIUS	43.1	.0	.0	14.4	24.9	1.5
ORDER DIPTERA						
FAMILY CHIRONOMIDAE	43.1	.0	.0	14.4	24.9	1.5
SUBFAMILY TANYPODINAE	129.2	.0	.0	43.1	74.6	4.6
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	129.2	86.1	.0	71.8	65.8	7.7
FAMILY TIPULIDAE	43.1	.0	43.1	28.7	24.9	3.1
TIPULA	86.1	43.1	43.1	57.4	24.9	6.2
TOTAL	990.3	559.7	1248.7	932.9	348.0	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - 1.384
VARIANCE - .0021
MAXIMUM INDEX - 2.485
EVENNESS - .557
NO OF TAXA - 12

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3
SAMPLE DATE - 10-04-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE
PHYLUM NEMATODA	43.1	43.1	.0	28.7	24.9	.3
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	12443.5	2454.3	16663.1	10520.3	7297.0	99.2
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER COLEOPTERA						
FAMILY HALIPLIDAE						
BRYCHIUS	.0	.0	43.1	14.4	24.9	.1
ORDER DIPTERA						
FAMILY CHIRONOMIDAE						

SUBFAMILY TANYPODINAE	.0	43.1	.0	14.4	24.9	.1
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	43.1	43.1	.0	28.7	24.9	.3
TOTAL	12529.6	2583.4	16706.1	10606.4	7255.1	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - .058
VARIANCE - .0000
MAXIMUM INDEX - 1.609
EVENNESS - .036
NO OF TAXA - 5

BENTHOS (MACROINVERTEBRATES) DENSITY AND DIVERSITY CALCULATIONS

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
NUMBER OF REPLICATES - 3
SAMPLE DATE - 11-03-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE
PHYLUM NEMATODA	86.1	.0	43.1	43.1	43.1	1.1
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	732.0	2195.9	2497.3	1808.4	944.3	46.0
FAMILY NAIDIDAE	.0	258.3	.0	86.1	149.2	2.2
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER EPHEMEROPTERA						
FAMILY BAETIDAE						
BAETIS	.0	43.1	43.1	28.7	24.9	.7
ORDER COLEOPTERA						
FAMILY ELMIDAE						
ZAITZEVIA PARVULA	43.1	43.1	.0	28.7	24.9	.7
ORDER DIPTERA						
FAMILY CHIRONOMIDAE						
SUBFAMILY TANYPODINAE	43.1	.0	43.1	28.7	24.9	.7
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNEMINI	1679.2	2411.2	1119.5	1736.6	647.8	44.2
SUBFAMILY CHIRONOMINAE						
TRIBE TANYTARSINI	.0	43.1	.0	14.4	24.9	.4
FAMILY EMPIDIDAE	.0	43.1	.0	14.4	24.9	.4
FAMILY TIPULIDAE						
TIPULA	172.2	172.2	86.1	143.5	49.7	3.6
TOTAL	2755.7	5209.9	3832.1	3932.5	1230.2	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - 1.121
VARIANCE - .0003
MAXIMUM INDEX - 2.303
EVENNESS - .487
NO OF TAXA - 10

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3
SAMPLE DATE - 11-03-82

	DENSITY(#/M2)	PERCENT

TAXON	REP 1	REP 2	REP 3	MEAN	S.D.	RELATIVE ABUNDANCE
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	129.2	215.3	344.5	229.6	108.4	17.6
FAMILY LUMBRICIDAE	.0	43.1	43.1	28.7	24.9	2.2
FAMILY NAIDIDAE	.0	43.1	43.1	28.7	24.9	2.2
PHYLUM MOLLUSCA						
CLASS GASTROPODA						
ORDER BASSOMATOPHORA						
FAMILY PHYSIDAE						
PHYSA	.0	43.1	215.3	86.1	113.9	6.6
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER EPHEMEROPTERA						
FAMILY BAETIDAE						
BAETIS	.0	.0	43.1	14.4	24.9	1.1
ORDER DIPTERA						
FAMILY CHIRONOMIDAE						
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	559.7	215.3	1679.2	818.1	765.4	62.6
SUBFAMILY CHIRONOMINAE						
TRIBE TANYTARSINI	.0	43.1	43.1	28.7	24.9	2.2
FAMILY TIPULIDAE						
TIPULA	.0	43.1	172.2	71.8	89.6	5.5
TOTAL	688.9	645.9	2583.4	1306.1	1105.4	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - 1.239
VARIANCE - .0010
MAXIMUM INDEX - 2.079
EVENNESS - .595
NO OF TAXA - 8

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3
SAMPLE DATE - 11-03-82

TAXON	DENSITY(#/M2) REP 1	REP 2	REP 3	MEAN	S.D.	PERCENT RELATIVE ABUNDANCE
PHYLUM ANNELIDA						
CLASS OLIGOCHAETA						
ORDER HAPLOTAXIDA						
FAMILY TUBIFICIDAE	1636.2	2755.7	1550.1	1980.6	672.6	95.2
PHYLUM MOLLUSCA						
CLASS GASTROPODA						
ORDER BASSOMATOPHORA						
FAMILY PHYSIDAE						
PHYSA	.0	43.1	.0	14.4	24.9	.7
CLASS BIVALVIA						
ORDER HETERODONTA						

FAMILY SPHAERIIDAE						
PISIDIUM	43.1	.0	.0	14.4	24.9	.7
PHYLUM ARTHROPODA						
CLASS INSECTA						
ORDER DIPTERA						
FAMILY CHIRONOMIDAE						
SUBFAMILY ORTHOCLADIINAE						
TRIBES ORTHOCLADIINI AND METRIOCNEMIINI	43.1	.0	172.2	71.8	89.6	3.4
TOTAL	1722.3	2798.7	1722.3	2081.1	621.5	100.0

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX - .232
VARIANCE - .0093
MAXIMUM INDEX - 1.386
EVENNESS - .167
NO OF TAXA - 4

TABLE 2.5.2-4

SHANNON-WEINER DIVERSITY (H'), EVENNESS (E), AND TOTAL NUMBER OF TAXA (N) IN BENTHIC MACROINVERTEBRATE SAMPLES COLLECTED FROM PICEANCE CREEK, MAY THROUGH NOVEMBER 1982, TRACT C-b

Sample Date	Stewart Station			Middle Station			Hunter Station		
	H'	E	N	H'	E	N	H'	E	N
June 1	1.08	0.45	11	0.44	0.17	13	0.22	0.14	5
June 30	0.64	0.31	8	0.03	0.02	5	0.16	0.11	4
July 29	0.53	0.27	7	0.63	0.30	8	1/		
September 2	0.26	0.24	3	0.95	0.59	5	0.12	0.08	4
October 4	1.13	0.47	11	1.38	0.56	12	0.06	0.04	5
November 3	1.12	0.49	10	1.24	0.60	8	0.23	0.17	4

1/ No samples collected due to a flash flood.

Mean densities ranged from 358.8 organisms/m^2 at Middle Station in September to 25,504.1 organisms/m^2 at Middle Station in July (Table 2.5.2-5). No consistent patterns involving density were apparent.

The order Haplotaxida was the dominant group of organisms in 1982 as measured by average percent relative abundance (Table 2.5.2-6). Haplotaxida comprised 97% of the organisms collected at Hunter station, 80% at Stewart Station, and 78% at Middle Station. Diptera was the second most abundant order at all stations and exhibited average relative abundances of 17% at Middle Station, 134% at Stewart Station, and 2% at Hunter Station. All other taxonomic groups collected in 1982 were represented by relatively low numbers.

Three taxa were collected in 1982 that did not appear in 1981 (Table 2.5.2-7). Twenty taxa that were present in 1981 were not encountered in 1982.

The results of the LSD test for evaluating differences between 1981 and 1982 benthic macroinvertebrate density calculated at each sample location during each sample period are provided in Table 2.5.2-8. The comparison of density data between stations for 1982 is provided in Table 2.5.2-9. In a comparison of 1981 with 1982 data, no differences are noted for July and September samples at Stewart Station; June, July, August and October samples at Middle Station; and August and September samples at Hunter Station. The May densities for both years were not significantly different at any station while July and August samples showed the greater disparity in densities for all stations. In a comparison of station density data from each station during 1982, densities were most similar for stations in close proximity (Stewart and Middle, Middle and Hunter) and most different for the two stations farthest apart on Piceance Creek: Stewart and Hunter. A comparison of Stewart plus Middle Station densities with Hunter Station diversities revealed a significant difference at the 10% level for August and September samples. Samples from other months showed no significant difference.

In order to evaluate whether Tract C-b development may have been responsible for the observed differences between 1981 and 1982 data and the differences between some sampling stations, the results of this investigation were compared to previous benthic macroinvertebrate studies of the Piceance Creek. The 1974-1976 C-b baseline study (C-b Annual Report 1977), as well as the study by Gray and Ward (1978), provide site-specific pre-development data which may be compared to current results. While these data are not in a form allowing statistical comparison to the 1981 and 1982 data, comparisons of general trends in taxonomic composition and density are possible. Strict comparisons of diversity indices from previous years is not possible due to differences in taxonomic levels of identification used.

TABLE 2.5.2-5

MEAN DENSITIES (#/m^2) OF BENTHIC MACROINVERTEBRATE SAMPLES COLLECTED FROM PICEANCE CREEK, MAY THROUGH NOVEMBER 1982, TRACT C-b

Sample Date	Stewart Station	Middle Station	Hunter Station
June 1	3,085.8	7,563.7	4,205.2
June 30	2,353.8	18,442.8	9,512.0
July 29	11,180.5	25,504.1	1/
September 2	732.0	358.8	9,214.2
October 4	1,320.4	932.9	10,606.4
November 3	3,932.5	1,306.1	2,081.1

1/ No samples collected due to a flash flood.

TABLE 2.5.2-6

AVERAGE PERCENT RELATIVE ABUNDANCE OF BENTHIC FAUNA IN PICEANCE CREEK, TRACT C-b, 1982
(values rounded to the nearest percent)1/

Taxon	Stewart Station	Middle Station	Hunter Station 2/
Phylum Nematoda	3	1	+
Order Haplotaxida	80	78	97
Order Rhynchobdellida	+	1	+
Order Acarina	+	+	-
Order Ephemeroptera	3	1	+
Order Trichoptera	+	-	-
Order Coleoptera	+	1	+
Order Diptera	13	17	2
Order Bassomatophora	1	3	+
Order Heterodonta	+	-	+

1/ + = Present at less than 1%
- = Absent

2/ Based on five sampling periods; no samples collected in July

TABLE 2.5.2-7

BENTHIC MACROINVERTEBRATE TAXA ENCOUNTERED IN 1982 SAMPLES AT TRACT C-b BUT NOT IN 1981; AND THOSE ENCOUNTERED IN 1981 BUT ABSENT FROM THE 1982 LIST

Taxa Present in 1982 but not in 1981	Taxa Absent in 1982 but Present in 1981
Helobdella stagnalis	*Hyalella azteca*
Zaitzevia parvula	*Gammarus lacustris*
Agabinus	*Ephemerella (Serratella)*
	Choroterpes
	Isoperla
	Hydroptila
	Hesperophylax
	Glossosoma
	Helichus
	Heliophorus
	Agabus
	Oreodytes and *Deronectes*
	Diamesini
	Prodiamesini
	Corynoneurini
	Dolichopodidae
	Simulium
	Muscidae
	Dicranota
	Euparyphus

TABLE 2.5.2-8

COMPARISON OF 1981 AND 1982 BENTHIC MACROINVERTEBRATE DENSITIES AT EACH SAMPLING STATION DURING EACH SAMPLING PERIOD USING FISHER'S LSD PROCEDURE (1949)1/

Month	Stewart	Middle	Hunter
May	-	-	-
June	-	5%	-
July	1%	1%	No data - 1982
August	-	1%	2%
September	10%	-	5%
October	-	10%	-

1/ - = No significant difference
10% = Difference significant at the 10% level
5% = Difference significant at the 5% level
2% = Difference significant at the 2% level
1% = Difference significant at the 1% level

TABLE 2.5.2-9

COMPARISON OF BENTHIC MACROINVERTEBRATE DENSITIES
BETWEEN EACH SAMPLING STATION DURING 1982
USING FISHER'S LSD PROCEDURE (1949)1/

Comparison	May	June	July	August	September	October
Stewart-Middle	-	2%	10%	-	-	1%
Stewart-Hunter	-	5%	2/	5%	2%	5%
Middle-Hunter	-	-	2/	-	10%	-
Stewart and Middle-Hunter	-	-	2/	10%	10%	-

1/ - = No significant difference
10% = Difference significant at the 10% level
5% = Difference significant at the 5% level
2% = Difference significant at the 2% level
1% = Difference significant at the 1% level

2/ No data for Hunter Station

Twenty-five taxa were collected in 1982 from Stewart Station in contrast with the 38 taxa found in 1981. Haplotaxida (primarily Tubificidae) was the dominant benthic group at this station during all 1982 sampling periods except November and comprised approximately 72%, 87%, 98%, 96%, 79%, and 48% of the total mean macroinvertebrate densities for the six sampling periods, respectively. Diptera (primarily chironomids) was the most abundant group collected in November at Stewart Station with 49% relative abundance. These results are very different from the 1981 monitoring study when Haplotaxida was dominant only in August and co-dominant in June. Also in 1981 at Stewart Station, Diptera was the most abundant order in May, September, and November and co-dominant in June; Dipterans comprised 50% of all macroinvertebrates collected in 1981. Ephemeroptera was dominant in July 1981 and had an overall average relative abundance of 10%. In contrast, Ephemeroptera was near abundant in 1982 and accounted for only 3% of the total macroinvertebrates collected at Stewart Station.

In 1980 at Stewart Station, Ephemeroptera was the dominant order in May, June, and September, Diptera dominated in July, and Trichoptera was the major taxon in November. During the 1974 through 1976 baseline study in the vicinity of Stewart Station, Ephemeroptera comprised 20% of the fauna, Diptera 32% and Haplotaxida 43%. From August 1975 to July 1976, Gray and Ward (1978) found Ephemeroptera to be 36% of the fauna at a Piceance Creek site just upstream from Stewart Station. Diptera and Haplotaxida comprised 16% and 34% of the fauna, respectively. From August 1976 to April 1977, Ephemeroptera accounted for 30% of the fauna, Diptera 12% and Haplotaxida 40% (Gray and Ward 1978).

Twenty-four taxa were collected from Middle Station in 1982 as compared to 31 in 1981. The findings at this station were very similar to those found at Stewart Station. Haplotaxida was again the dominant group during all sampling periods except November when Diptera was most abundant. These two orders comprised 95% of all macroinvertebrates collected at Middle Station in 1982. Average relative abundances of the major groups were fairly similar to those found in 1981. In 1982, average relative abundances of Haplotaxida, Diptera, and Ephemeroptera were 78%, 17%, and 1%, respectively, as compared to 1981 values of 70%, 23%, and 2%. In 1980, values were 36%, 44%, and 6% for Haplotaxida, Diptera, and Ephemeroptera, respectively. Macroinvertebrates were not sampled at Middle Station prior to 1980.

Only 11 taxa were recorded from Hunter Station in 1982, while 27 taxa were reported in 1981. The reduced species diversity at the station probably resulted from a flash flood that destroyed the July sample and deposited 2-4 feet of silt; this silt remained at the station through the remainder of the 1982 sampling period. Haplotaxida, a group of organisms that thrive on a silt substrate, was the most abundant group of organisms collected (97%) and was dominant during all sampling dates. Dipterans comprised 2% of the total densities at this station and all other groups collected were present at less than 1%. In 1981, the May and September samples at Hunter Station were dominated by Diptera while Haplotaxida was the most abundant group on all other sampling dates. While the dominant groups at this station have not changed between 1981 and 1982, the average relative abundance of each group has changed. In 1981, relative abundance indices were 55%, 32%, and 10% for Haplotaxida, Diptera, and Ephemeroptera, respectively, while in 1980, these values were 58%, 29%, and 12%, respectively.

During baseline studies (1974 through 1976), Haplotaxida comprised 47%, Ephemeroptera 20%, and Diptera 29% of the fauna at Hunter Station. Gray and Ward (1978), at a sampling site near Hunter Station, noted that Haplotaxida accounted for 34% of the fauna between August 1975 and July 1976, and 59% between August 1976 and April 1977. Similarly, the Ephemeroptera were 46% and 10%, while the Diptera were 18% and 27%, respectively.

In comparing the benthic macroinvertebrate data to data collected in 1980 and 1981, it is apparent that changes have occurred. While the three orders Haplotaxida, Diptera and Ephemeroptera have been consistently dominant in each year, the average relative abundance of each group has changed. Haplotaxida has increased in dominance each year and Ephemeroptera and Diptera have declined. Members of the order Plecoptera were absent in 1982 and the orders Coleoptera and Trichoptera generally declined to comprise less than 1% average relative abundance of the benthic fauna at each station.

Comparisons with previous studies must be made with caution because factors such as station location, time of sampling, length of sampling season, and taxonomic level of identification have not been constant from year to year. However, Gray and Ward (1978) reported that density, diversity and biomass tended to decrease from upstream to downstream in Piceance Creek. They also attributed the differences between stations to the influence of agriculture (irrigation withdrawals), springfed tributaries and ground water inflows. This observation is supported by data from 1980-1982. Moreover, siltation tends to be increasing at all stations (a flash flood at Hunter Station in late July changed the substrate composition from 40 to 90% silt) and accounts for the increases in relative abundance of Haplotaxida at all stations.

2.5.2.4 Periphyton

2.5.2.4.1 Methods of Periphyton Sampling & Analyses

The 1982 periphyton sampling stations located in Piceance Creek are identified as WP01 (Stewart Gulch near USGS Station WU07), WP02 (Middle Station) and WP03 (Hunter Creek near USGS Station WU61). Station WP01 was moved in 1977 from a baseline location of P-1 farther upstream to its current position as a control station above development impact.

Periphyton are collected from artificial substrates (glass slides) at each station during every sampling period. The glass slides are incubated in the water for at least 21 days. Nine slides are collected from each station, placed in individual cytomailers and preserved with 4% formalin. Three of the nine slides are used for taxonomic identification and enumeration, three for biomass determinations and three are extra slides in case any of the others become damaged.

The cytomailers are sent to Mariah Associates' Aquatics Laboratory in Laramie, Wyoming. All field procedures are executed by CB personnel.

Six collections were obtained during the period of June through October 1982. No periphyton sample is available from Station WP03, Hunter Creek, for July due to the July 29 flash flood.

Upon arrival, the biomass is removed from the slides with a razor blade, and the scrapings placed in separate crucibles to be dehydrated in a drying oven at 105 to 110°C. Samples are then cooled to room temperature in a dessicator and weighed to the nearest 0.0001 g (gross dry weight). After ashing in a muffle furnace at 450°C for approximately four hours, the samples are rewet upon cooling to replace their water of hydration, redried to a constant weight at 105 to 110°C and weighed to the nearest 0.0001 g (gross ash weight). Ash-free dry weight is obtained by subtracting gross ash weight from gross dry weight since the evaporating dish tare is assumed to be identical for the two weights.

Ash-free dry weight biomass is calculated according to the following equation:

$$\text{biomass (mg/cm}^2\text{)} = \frac{Wd - Wa}{As}$$

where: Wd = dry weight plus tare, mg
Wa = ash weight plus tare, mg
As = area scraped from slide, cm^2

Algae other than diatoms are identified directly from the slides with 200x or 400x magnification. The periphyton are then scraped from each slide with a razor blade and placed into separate jars. The contents of each jar are identified according to species composition and relative abundance.

2.5.2.4.2 Results

Periphyton data are presented in Tables 2.5.2-10 through -14 as species lists, density and diversity.

The diatoms (Bacillariophyta), represented by 131 taxa, were the major component of the algal collections. The green algae (Chlorophyta) were represented by 10 taxa, blue-green algae (Cyanophyta) represented by 7 taxa, and euglenoids (Euglenophyta) represented by 4 taxa.

During 1982, the diatoms were also the most abundant periphyton in all samples and accounted for 76 to 100% of the total mean periphyton density. The diatoms that dominated the periphyton of Piceance Creek in 1982 have similar known ecological requirements and tolerance. They attain best development in alkaline waters and are common in oligotrophic to mesotrophic (slightly to moderately organically enriched) rivers and streams of this region (Lowe 1974; Patrick and Reimer 1966).

PERIPHYTON DATA

PERIPHYTON DATA

TABLE 2.5.2-10

PERIPHYTON SPECIES LIST

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK
1982

TAXON	STATION NUMBER WP01	WP02	WP03
BACILLARIOPHYTA			
ACHNANTHES LANCEOLATA	X	X	X
ACHNANTHES LANCEOLATA VAR. DUBIA	X	X	X
ACHNANTHES LINEARIS	X	X	X
ACHNANTHES MINUTISSIMA	X	X	X
AMPHORA OVALIS	X	X	X
AMPHORA OVALIS VAR. AFFINIS	X	X	X
AMPHORA OVALIS VAR. PEDICULUS			X
AMPHORA PERPUSILLA	X	X	X
AMPHORA VENETA	X	X	
CALONEIS AMPHISBAENA	X	X	X
CALONEIS SP.		X	
CALONEIS VENTRICOSA VAR. MINUTA	X		
COCCONEIS PEDICULUS	X	X	X
COCCONEIS PLACENTULA	X		
COCCONEIS PLACENTULA VAR. EUGLYPTA	X	X	X
COCCONEIS PLACENTULA VAR. LINEATA	X	X	X
CYCLOTELLA KUTZINGIANA		X	
CYCLOTELLA MENEGHINIANA	X	X	X
CYMATOPLEURA SOLEA	X		X
CYMBELLA AFFINIS	X	X	X
CYMBELLA ASPERA	X		
CYMBELLA CYMBIFORMIS		X	X
CYMBELLA LAEVIS		X	
CYMBELLA MUELLERI	X		
CYMBELLA MICROCEPHALA		X	
CYMBELLA MINUTA	X		
CYMBELLA MINUTA VAR. SILESIACA	X	X	X
CYMBELLA SINUATA	X	X	X
DENTICULA ELEGANS	X		X
DENTICULA SP.		X	
DIATOMA TENUE		X	
DIATOMA TENUE VAR. ELONGATUM	X	X	X
DIATOMA VULGARE	X	X	X
ENTOMONEIS ORNATA			X
EPITHEMIA SOREX	X		
FRAGILARIA CONSTRUENS		X	
FRAGILAREA CONSTRUENS VAR. BINODIS	X	X	X
FRAGILARIA CONSTRUENS VAR. VENTER	X	X	X
FRAGILARIA CROTONENSIS	X		
FRAGILARIA LEPTOSTAURON	X	X	X
FRAGILARIA VAUCHERIAE	X	X	X
FRUSTULIA RHOMBOIDES		X	X
GOMPHONEMA ANGUSTATUM		X	X
GOMPHONEMA GRACILE	X		
GOMPHONEMA INTRICATUM			X
GOMPHONEMA OLIVACEUM	X	X	X
GOMPHONEMA PARVULUM	X	X	X
GOMPHONEMA SUBCLAVATUM	X	X	X
GOMPHONEMA TENELLUM	X	X	X
GOMPHONEMA SP.	X	X	X

GYROSIGMA SPENCERII	X	X	X
HANTZSCHIA AMPHIOXYS	X	X	X
MASTOGLOIA SPP.			X
MERIDION CIRCULARE	X	X	
MERIDION CIRCULARE VAR. CONSTRICTUM		X	
NAVICULA ARVENSIS	X	X	X
NAVICULA CINCTA		X	
NAVICULA CRYPTOCEPHALA	X	X	
NAVICULA CRYPTOCEPHALA VAR. VENETA	X	X	X
NAVICULA CUSPIDATA		X	X
NAVICULA HEUFLERI	X	X	X
NAVICULA LANCEOLATA VAR. DUBIA			X
NAVICULA LUZONENSIS			X
NAVICULA MINIMA	X	X	X
NAVICULA MINUSCULA	X		
NAVICULA MUTICA	X	X	X
NAVICULA MUTICA VAR. UNDULATA	X	X	X
NAVICULA NOTHA	X	X	X
NAVICULA PELLICULOSA	X		
NAVICULA PUPULA		X	X
NAVICULA PUPULA VAR. CAPITATA		X	X
NAVICULA PUPULA VAR. RECTANGULARIS	X		
NAVICULA PROTRACTA			X
NAVICULA PYGMAEA			X
NAVICULA RADIOSA		X	
NAVICULA RHYNCHOCEPHALA	X	X	
NAVICULA SALINARUM VAR. INTERMEDIA	X	X	X
NAVICULA SECRETA VAR. APICULATA	X	X	X
NAVICULA TRIPUNCTATA	X	X	
NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	X	X	X
NAVICULA VIRIDULA		X	
NAVICULA VIRIDULA VAR. AVENACEA	X	X	X
NAVICULA SP.	X	X	X
NITZSCHIA ACICULARIS	X	X	X
NITZSCHIA AMPHIBIA	X	X	
NITZSCHIA APICULATA	X	X	X
NITZSCHIA CAPITELLATA	X	X	
NITZSCHIA COMMUNIS	X	X	
NITZSCHIA DENTICULA	X		
NITZSCHIA DISSIPATA	X	X	X
NITZSCHIA FONTICOLA	X	X	X
NITZSCHIA FRUSTULUM	X	X	X
NITZSCHIA GRACILIS		X	
NITZSCHIA HUNGARICA	X	X	X
NITZSCHIA IGNORATA	X	X	
NITZSCHIA KUTZINGIANA	X		
NITZSCHIA LINEARIS	X	X	X
NITZSCHIA PALEACEA	X	X	X
NITZSCHIA PALEA	X	X	X
NITZSCHIA RECTA		X	
NITZSCHIA SIGMOIDEA	X	X	X
NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS	X	X	X
NITZSCHIA SP.	X	X	X
PINNULARIA BREBISSONII		X	X
PINNULARIA MICROSTAURON		X	
PINNULARIA VIRIDIS VAR. MINOR			X
PINNULARIA SP.			X
RHOICOSPHENIA CURVATA	X	X	X
RHOPALODIA GIBBA VAR. VENTRICOSA		X	X
RHOPALODIA MUSCULUS	X	X	X
SKELETONEMA POTAMOS	X		
STAURONEIS ANCEPS			X
STAURONEIS SMITHII		X	
STEPHANODISCUS SP.	X		X

STEPHANODISCUS TENUIS		X	
SURIRELLA ANGUSTATA		X	
SURIRELLA OVALIS	X	X	X
SURIRELLA OVATA	X	X	X
SYNEDRA ACUS	X	X	X
SYNEDRA AMPHICEPHALA	X	X	X
SYNEDRA DELICATISSIMA	X	X	X
SYNEDRA FASCICULATA	X	X	X
SYNEDRA FASCICULATA VAR. TRUNCATA	X	X	
SYNEDRA MINUSCULA	X	X	
SYNEDRA PULCHELLA	X	X	X
SYNEDRA RUMPENS VAR. FAMILIARIS		X	
SYNEDRA ULNA	X	X	X
SYNEDRA ULNA VAR. DANICA		X	
SYNEDRA SP.		X	
THALASSIOSIRA FLUVIATILIS	X	X	X
UNIDENTIFIED PENNATE DIATOMS	X	X	X
CHLOROPHYTA			
ANKISTRODESMUS SP.		X	
CHLAMYDOMONAS SP.	X	X	X
CLOSTERIUM SP.	X	X	
COELASTRUM SP.		X	
UNIDENTIFIED GREEN COCCOID		X	
MOUGEOTIA SP.	X	X	
OEDOGONIUM SP.	X		X
STIGEOCLONIUM TENUE	X	X	X
TETRAEDRON MINIMUM	X		
UNIDENTIFIED FILAMENT	X		X
CHRYSOPHYTA			
CYANOPHYTA			
ANABAENA SP.	X	X	X
CHROOCOCCUS SP.	X		X
LYNGBYA SP.	X	X	X
MERISMOPEDEA SP.		X	
OSCILLATORIA TENVIS	X	X	X
OSCILLATORIA SP.	X	X	X
PHORMIDIUM SP.	X	X	
EUGLENOPHYTA			
EUGLENA ACUS	X		
EUGLENA SP.		X	
PHACUS SP.	X	X	
TRACHELOMONAS SP.		X	
RHODOPHYTA			

X = ORGANISM IDENTIFIED TO THIS TAXONOMIC LEVEL OBSERVED AT SAMPLING STATION

PERIPHYTON SPECIES LIST

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SPECIES OCCURRENCE BY SAMPLING DATE AT STATION WP01
1982

TAXON	SAMPLING DATE MAY	JUNE	JULY	AUG	SEPT	OCT
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA						X
ACHNANTHES LANCEOLATA VAR. DUBIA	X	X	X	X	X	X
ACHNANTHES LINEARIS	X	X	X	X		X
ACHNANTHES MINUTISSIMA	X	X	X	X	X	X
AMPHORA OVALIS	X					
AMPHORA OVALIS VAR. AFFINIS						X
AMPHORA PERPUSILLA	X	X	X	X	X	X
AMPHORA VENETA						X
CALONEIS AMPHISBAENA		X	X			
CALONEIS VENTRICOSA VAR. MINUTA			X			
COCCONEIS PEDICULUS		X	X	X		X
COCCONEIS PLACENTULA			X			
COCCONEIS PLACENTULA VAR. EUGLYPTA	X		X	X		
COCCONEIS PLACENTULA VAR. LINEATA	X	X	X	X	X	X
CYCLOTELLA MENEGHINIANA	X	X	X	X	X	X
CYMATOPLEURA SOLEA			X			
CYMBELLA AFFINIS			X	X	X	X
CYMBELLA ASPERA				X		
CYMBELLA MUELLERI				X		
CYMBELLA MINUTA	X	X				
CYMBELLA MINUTA VAR. SILESIACA	X		X	X	X	X
CYMBELLA SINUATA	X		X	X	X	X
DENTICULA ELEGANS		X				
DIATOMA TENUE VAR. ELONGATUM						X
DIATOMA VULGARE	X	X	X	X	X	X
EPITHEMIA SOREX	X					
FRAGILARIA CONSTRUENS VAR. BINODIS	X		X			X
FRAGILARIA CONSTRUENS VAR. VENTER			X			
FRAGILARIA CROTONENSIS	X	X				
FRAGILARIA LEPTOSTAURON	X					
FRAGILARIA VAUCHERIAE	X	X	X	X	X	X
GOMPHONEMA GRACILE					X	
GOMPHONEMA OLIVACEUM	X	X	X	X	X	X
GOMPHONEMA PARVULUM	X	X	X	X	X	X
GOMPHONEMA SUBCLAVATUM			X			X
GOMPHONEMA TENELLUM	X			X	X	X
GOMPHONEMA SP.				X	X	
GYROSIGMA SPENCERII	X					
HANTZSCHIA AMPHIOXYS	X		X	X		X
MERIDION CIRCULARE	X					
NAVICULA ARVENSIS	X			X	X	
NAVICULA CRYPTOCEPHALA		X	X	X		
NAVICULA CRYPTOCEPHALA VAR. VENETA	X	X	X	X	X	X
NAVICULA HEUFLERI				X	X	X
NAVICULA MINIMA			X	X	X	X
NAVICULA MINUSCULA		X				
NAVICULA MUTICA		X		X	X	X
NAVICULA MUTICA VAR. UNDULATA	X					X

NAVICULA NOTHA	X		X		X	X
NAVICULA PELLICULOSA	X			X		
NAVICULA PUPULA VAR. RECTANGULARIS	X					
NAVICULA RHYNCHOCEPHALA						X
NAVICULA SALINARUM VAR. INTERMEDIA				X	X	X
NAVICULA SECRETA VAR. APICULATA	X	X	X	X	X	X
NAVICULA TRIPUNCTATA						X
NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	X		X	X	X	X
NAVICULA VIRIDULA VAR. AVENACEA	X	X	X	X	X	X
NAVICULA SP.			X			
NITZSCHIA ACICULARIS	X	X				
NITZSCHIA AMPHIBIA	X	X		X		
NITZSCHIA APICULATA	X	X	X	X		X
NITZSCHIA CAPITELLATA		X	X			X
NITZSCHIA COMMUNIS		X	X			X
NITZSCHIA DENTICULA				X		
NITZSCHIA DISSIPATA	X	X	X	X	X	X
NITZSCHIA FONTICOLA	X	X	X	X		
NITZSCHIA FRUSTULUM	X	X	X	X	X	X
NITZSCHIA HUNGARICA			X	X		
NITZSCHIA IGNORATA	X			X		
NITZSCHIA KUTZINGIANA	X					
NITZSCHIA LINEARIS		X	X		X	X
NITZSCHIA PALEACEA		X	X			X
NITZSCHIA PALEA	X	X	X	X	X	X
NITZSCHIA SIGMOIDEA	X		X	X		X
NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS			X			
NITZSCHIA SP.	X	X	X	X		
RHOICOSPHENIA CURVATA	X	X	X	X	X	X
RHOPALODIA MUSCULUS		X	X			
SKELETONEMA POTAMOS	X					
STEPHANODISCUS SP.			X			
SURIRELLA OVALIS	X			X		
SURIRELLA OVATA	X	X	X	X	X	X
SYNEDRA ACUS		X	X	X		X
SYNEDRA AMPHICEPHALA	X	X	X			
SYNEDRA DELICATISSIMA			X		X	X
SYNEDRA FASCICULATA				X		
SYNEDRA FASCICULATA VAR. TRUNCATA				X		
SYNEDRA MINUSCULA				X		
SYNEDRA PULCHELLA				X		
SYNEDRA ULNA	X	X	X	X	X	
THALASSIOSIRA FLUVIATILIS		X	X			
UNIDENTIFIED PENNATE DIATOMS	X	X	X	X		
CHLOROPHYTA						
CHLAMYDOMONAS SP.			X			
CLOSTERIUM SP.		X				
MOUGEOTIA SP.			X	X		
OEDOGONIUM SP.			X			
STIGEOCLONIUM TENUE		X	X	X	X	
TETRAEDRON MINIMUM			X			
UNIDENTIFIED FILAMENT	X			X		
CHRYSOPHYTA						
CYANOPHYTA						
ANABAENA SP.		X	X	X		X
CHROOCOCCUS SP.				X		
LYNGBYA SP.			X	X		X
OSCILLATORIA TENVIS		X	X		X	

OSCILLATORIA SP.		X	
PHORMIDIUM SP.	X	X	X
EUGLENOPHYTA			
EUGLENA ACUS	X		
PHACUS SP.		X	
RHODOPHYTA			

X = ORGANISM IDENTIFIED TO THIS TAXONOMIC LEVEL OBSERVED AT SAMPLING STATION

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SPECIES OCCURRENCE BY SAMPLING DATE AT STATION WP02
1982

TAXON	SAMPLING DATE MAY	JUNE	JULY	AUG	SEPT	OCT
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA	X		X		X	
ACHNANTHES LANCEOLATA VAR. DUBIA	X	X	X	X	X	X
ACHNANTHES LINEARIS	X	X	X	X	X	
ACHNANTHES MINUTISSIMA	X	X	X	X	X	X
AMPHORA OVALIS	X			X	X	
AMPHORA OVALIS VAR. AFFINIS				X		
AMPHORA PERPUSILLA	X	X	X	X	X	X
AMPHORA VENETA			X			
CALONEIS AMPHISBAENA	X	X				
CALONEIS SP.		X	X			
COCCONEIS PEDICULUS	X	X		X	X	X
COCCONEIS PLACENTULA VAR. EUGLYPTA				X		X
COCCONEIS PLACENTULA VAR. LINEATA	X	X	X	X	X	X
CYCLOTELLA KUTZINGIANA	X					
CYCLOTELLA MENEGHINIANA	X	X	X	X	X	X
CYMBELLA AFFINIS	X	X		X	X	X
CYMBELLA CYMBIFORMIS				X	X	
CYMBELLA LAEVIS		X				
CYMBELLA MICROCEPHALA	X					
CYMBELLA MINUTA VAR. SILESIACA	X	X	X	X	X	X
CYMBELLA SINUATA			X	X	X	X
DENTICULA SP.		X				
DIATOMA TENUE		X				
DIATOMA TENUE VAR. ELONGATUM	X	X		X		
DIATOMA VULGARE	X	X	X	X	X	X
FRAGILARIA CONSTRUENS						X
FRAGILAREA CONSTRUENS VAR. BINODIS	X	X	X		X	
FRAGILARIA CONSTRUENS VAR. VENTER		X			X	
FRAGILARIA LEPTOSTAURON	X	X		X	X	X
FRAGILARIA VAUCHERIAE	X	X	X	X	X	X
FRUSTULIA RHOMBOIDES					X	
GOMPHONEMA ANGUSTATUM	X					
GOMPHONEMA OLIVACEUM	X	X	X	X	X	X
GOMPHONEMA PARVULUM	X	X	X	X	X	X
GOMPHONEMA SUBCLAVATUM			X	X		X
GOMPHONEMA TENELLUM	X				X	X
GOMPHONEMA SP.	X			X		
GYROSIGMA SPENCERII		X		X	X	
HANTZSCHIA AMPHIOXYS	X		X	X	X	X
MERIDION CIRCULARE	X					
MERIDION CIRCULARE VAR. CONSTRICTUM		X				
NAVICULA ARVENSIS	X			X	X	X
NAVICULA CINCTA	X					
NAVICULA CRYPTOCEPHALA		X	X	X		
NAVICULA CRYPTOCEPHALA VAR. VENETA	X	X	X	X	X	X
NAVICULA CUSPIDATA			X	X		
NAVICULA HEUFLERI				X	X	X
NAVICULA MINIMA			X	X	X	X

NAVICULA MUTICA	X			X	X	
NAVICULA MUTICA VAR. UNDULATA		X		X	X	
NAVICULA NOTHA	X		X	X	X	X
NAVICULA PUPULA				X	X	
NAVICULA PUPULA VAR. CAPITATA		X				
NAVICULA RADIOSA	X					
NAVICULA RHYNCHOCEPHALA	X	X		X		
NAVICULA SALINARUM VAR. INTERMEDIA				X	X	X
NAVICULA SECRETA VAR. APICULATA	X	X	X	X	X	X
NAVICULA TRIPUNCTATA						X
NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	X	X	X	X	X	X
NAVICULA VIRIDULA			X			
NAVICULA VIRIDULA VAR. AVENACEA	X	X	X	X	X	X
NAVICULA SP.				X		
NITZSCHIA ACICULARIS	X				X	
NITZSCHIA AMPHIBIA				X	X	
NITZSCHIA APICULATA		X	X	X	X	X
NITZSCHIA CAPITELLATA	X	X	X			X
NITZSCHIA COMMUNIS	X		X			
NITZSCHIA DISSIPATA	X	X	X	X	X	X
NITZSCHIA FONTICOLA	X	X	X	X	X	
NITZSCHIA FRUSTULUM	X	X	X	X	X	X
NITZSCHIA GRACILIS		X				X
NITZSCHIA HUNGARICA		X				
NITZSCHIA IGNORATA						X
NITZSCHIA LINEARIS	X	X	X		X	X
NITZSCHIA PALEACEA		X	X			
NITZSCHIA PALEA	X	X	X	X	X	X
NITZSCHIA RECTA	X					
NITZSCHIA SIGMOIDEA		X	X		X	
NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS		X	X	X		X
NITZSCHIA SP.	X	X	X	X	X	X
PINNULARIA BREBISSONII	X			X	X	
PINNULARIA MICROSTAURON		X				
RHOICOSPHENIA CURVATA	X	X	X	X	X	X
RHOPALODIA GIBBA VAR. VENTRICOSA	X	X				
RHOPALODIA MUSCULUS		X	X			
STAURONEIS SMITHII					X	
STEPHANODISCUS TENUIS	X					
SURIRELLA ANGUSTATA					X	
SURIRELLA OVALIS	X	X		X		
SURIRELLA OVATA	X	X	X	X	X	X
SYNEDRA ACUS		X				X
SYNEDRA AMPHICEPHALA	X	X				
SYNEDRA DELICATISSIMA	X		X	X		X
SYNEDRA FASCICULATA				X	X	
SYNEDRA FASCICULATA VAR. TRUNCATA			X			
SYNEDRA MINUSCULA				X		
SYNEDRA PULCHELLA				X		
SYNEDRA RUMPENS VAR. FAMILIARIS				X		
SYNEDRA ULNA	X	X	X	X	X	X
SYNEDRA ULNA VAR. DANICA		X				
SYNEDRA SP.				X	X	
THALASSIOSIRA FLUVIATILIS		X	X	X		X
UNIDENTIFIED PENNATE DIATOMS	X	X	X	X	X	X
CHLOROPHYTA						
ANKISTRODESMUS SP.			X			
CHLAMYDOMONAS SP.		X	X			
CLOSTERIUM SP.				X		
COELASTRUM SP.		X				
UNIDENTIFIED GREEN COCCOID	X	X				
MOUGEOTIA SP.			X			

STIGEOCLONIUM TENUE		X	X	X		
CHRYSOPHYTA						
CYANOPHYTA						
ANABAENA SP.	X		X	X		
LYNGBYA SP.				X	X	X
MERISMOPEDEA SP.				X		
OSCILLATORIA TENVIS		X		X		
OSCILLATORIA SP.		X	X		X	
PHORMIDIUM SP.		X	X			
EUGLENOPHYTA						
EUGLENA SP.		X			X	
PHACUS SP.		X				
TRACHELOMONAS SP.			X			
RHODOPHYTA						

X = ORGANISM IDENTIFIED TO THIS TAXONOMIC LEVEL OBSERVED AT SAMPLING STATION

PERIPHYTON SPECIES LIST

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SPECIES OCCURRENCE BY SAMPLING DATE AT STATION WP03
1982

TAXON	SAMPLING DATE					
	MAY	JUNE	JULY	AUG	SEPT	OCT
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA	X	X				X
ACHNANTHES LANCEOLATA VAR. DUBIA	X	X		X	X	X
ACHNANTHES LINEARIS	X	X				
ACHNANTHES MINUTISSIMA	X	X			X	X
AMPHORA OVALIS	X					
AMPHORA OVALIS VAR. AFFINIS					X	X
AMPHORA OVALIS VAR. PEDICULUS		X				
AMPHORA PERPUSILLA	X	X			X	X
CALONEIS AMPHISBAENA	X	X				
COCCONEIS PEDICULUS	X	X		X		
COCCONEIS PLACENTULA VAR. EUGLYPTA				X		
COCCONEIS PLACENTULA VAR. LINEATA	X	X		X	X	X
CYCLOTELLA MENEGHINIANA	X	X			X	X
CYMATOPLEURA SOLEA		X				
CYMBELLA AFFINIS	X	X		X	X	X
CYMBELLA CYMBIFORMIS						X
CYMBELLA MINUTA VAR. SILESIACA	X	X			X	X
CYMBELLA SINUATA	X					X
DENTICULA ELEGANS					X	
DIATOMA TENUE VAR. ELONGATUM				X		X
DIATOMA VULGARE	X	X		X	X	X
ENTOMONEIS ORNATA					X	
FRAGILAREA CONSTRUENS VAR. BINODIS					X	
FRAGILARIA CONSTRUENS VAR. VENTER	X					
FRAGILARIA LEPTOSTAURON		X			X	X
FRAGILARIA VAUCHERIAE	X	X		X	X	X
FRUSTULIA RHOMBOIDES					X	
GOMPHONEMA ANGUSTATUM		X				
GOMPHONEMA INTRICATUM				X		
GOMPHONEMA OLIVACEUM	X			X	X	X
GOMPHONEMA PARVULUM	X	X		X	X	X
GOMPHONEMA SUBCLAVATUM	X	X		X		X
GOMPHONEMA TENELLUM				X	X	X
GOMPHONEMA SP.		X			X	
GYROSIGMA SPENCERII		X				
HANTZSCHIA AMPHIOXYS	X	X			X	
MASTOGLOIA SPP.						X
NAVICULA ARVENSIS		X		X	X	
NAVICULA CRYPTOCEPHALA VAR. VENETA	X	X		X	X	X
NAVICULA CUSPIDATA		X				
NAVICULA HEUFLERI	X	X		X	X	X
NAVICULA LANCEOLATA VAR. DUBIA						X
NAVICULA LUZONENSIS		X				
NAVICULA MINIMA		X			X	X
NAVICULA MUTICA		X			X	X
NAVICULA MUTICA VAR. UNDULATA					X	
NAVICULA NOTHA	X				X	X
NAVICULA PUPULA		X			X	X

NAVICULA PUPULA VAR. CAPITATA				X	
NAVICULA PROTRACTA		X			
NAVICULA PYGMAEA	X				
NAVICULA SALINARUM VAR. INTERMEDIA				X	X
NAVICULA SECRETA VAR. APICULATA	X	X	X	X	X
NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	X			X	X
NAVICULA VIRIDULA VAR. AVENACEA	X	X	X	X	X
NAVICULA SP.					X
NITZSCHIA ACICULARIS	X				
NITZSCHIA APICULATA	X	X	X	X	X
NITZSCHIA DISSIPATA	X	X	X	X	X
NITZSCHIA FONTICOLA	X	X	X		
NITZSCHIA FRUSTULUM	X	X	X	X	X
NITZSCHIA HUNGARICA	X	X		X	X
NITZSCHIA LINEARIS	X	X			
NITZSCHIA PALEACEA		X			
NITZSCHIA PALEA	X	X			X
NITZSCHIA SIGMOIDEA		X			X
NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS		X	X		
NITZSCHIA SP.	X	X		X	
PINNULARIA BREBISSONII				X	X
PINNULARIA VIRIDIS VAR. MINOR		X			
PINNULARIA SP.		X			
RHOICOSPHENIA CURVATA	X	X	X	X	X
RHOPALODIA GIBBA VAR. VENTRICOSA		X			
RHOPALODIA MUSCULUS		X		X	X
STAURONEIS ANICEPS				X	
STEPHANODISCUS SP.				X	X
SURIRELLA OVALIS	X	X			
SURIRELLA OVATA	X	X	X	X	X
SYNEDRA ACUS				X	X
SYNEDRA AMPHICEPHALA	X				X
SYNEDRA DELICATISSIMA		X			
SYNEDRA FASCICULATA	X				
SYNEDRA PULCHELLA		X		X	
SYNEDRA ULNA	X	X		X	X
THALASSIOSIRA FLUVIATILIS	X	X		X	
UNIDENTIFIED PENNATE DIATOMS		X		X	X
CHLOROPHYTA					
CHLAMYDOMONAS SP.			X		
OEDOGONIUM SP.			X		
STIGEOCLONIUM TENUE		X	X	X	
UNIDENTIFIED FILAMENT	X				
CHRYSOPHYTA					
CYANOPHYTA					
ANABAENA SP.			X		X
CHROOCOCCUS SP.			X		
LYNGBYA SP.			X		
OSCILLATORIA TENVIS		X			
OSCILLATORIA SP.		X			
EUGLENOPHYTA					
RHODOPHYTA					

X = ORGANISM IDENTIFIED TO THIS TAXONOMIC LEVEL OBSERVED AT SAMPLING STATION

TABLE 2.5.2-11

PERIPHYTON BENCH SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 06-01-82

C - 592   V - 110 ML   DF - 1:0   L - 50 MM   W - .33 MM   D - 1 MM   S - .5   A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA1 . ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1SKPOT	SKELETONEMA POTAMOS	4	
1NAARV	NAVICULA ARVENSIS	1	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	108	
1COCPU	COCCONEIS PLACENTULA VAR. EUGLYPTA	2	
1ACMIN	ACHNANTHES MINUTISSIMA	30	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	P	
1NIDIS	NITZSCHIA DISSIPATA	5	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	6	
1SUOVA	SURIRELLA OVATA	5	
1RHCUR	RHOICOSPHENIA CURVATA	9	
1CYCME	CYCLOTELLA MENEGHINIANA	P	
1NANOT	NAVICULA NOTHA	P	
1NIPAL	NITZSCHIA PALEA	4	
1NASEA	NAVICULA SECRETA VAR. APICULATA	6	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	1	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	5	
1NIFRU	NITZSCHIA FRUSTULUM	1	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	2	
1NISPP	NITZSCHIA SP.	4	
1FRAVA	FRAGILARIA VAUCHERIAE	1	
1NIFON	NITZSCHIA FONTICOLA	1	
1FRACR	FRAGILARIA CROTONENSIS	2	
1CYMSI	CYMBELLA SINUATA	2	
1NIAPI	NITZSCHIA APICULATA	3	
1SYAMP	SYNEDRA AMPHICEPHALA	2	
1DIVUL	DIATOMA VULGARE	P	
1GYSPE	GYROSIGMA SPENCERII	P	
1MERCI	MERIDION CIRCULARE	P	
1SYULN	SYNEDRA ULNA	P	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	P	
1AMPER	AMPHORA PERPUSILLA	P	
1NISIE	NITZSCHIA SIGMOIDEA	P	
1FRACB	FRAGILAREA CONSTRUENS VAR. BINODIS	P	
1SUOVL	SURIRELLA OVALIS	P	
1NAMUU	NAVICULA MUTICA VAR. UNDULATA	P	
1EPSOR	EPITHEMIA SOREX	P	
1FRALE	FRAGILARIA LEPTOSTAURON	P	
1ACLIN	ACHNANTHES LINEARIS	P	

Six collections were obtained during the period of June through October 1982. No periphyton sample is available from Station WP03, Hunter Creek, for July due to the July 29 flash flood.

Upon arrival, the biomass is removed from the slides with a razor blade, and the scrapings placed in separate crucibles to be dehydrated in a drying oven at 105 to 110°C. Samples are then cooled to room temperature in a dessicator and weighed to the nearest 0.0001 g (gross dry weight). After ashing in a muffle furnace at 450°C for approximately four hours, the samples are rewet upon cooling to replace their water of hydration, redried to a constant weight at 105 to 110°C and weighed to the nearest 0.0001 g (gross ash weight). Ash-free dry weight is obtained by subtracting gross ash weight from gross dry weight since the evaporating dish tare is assumed to be identical for the two weights.

Ash-free dry weight biomass is calculated according to the following equation:

$$\text{biomass (mg/cm}^2\text{)} = \frac{Wd - Wa}{As}$$

where: Wd = dry weight plus tare, mg
Wa = ash weight plus tare, mg
As = area scraped from slide, cm^2

Algae other than diatoms are identified directly from the slides with 200x or 400x magnification. The periphyton are then scraped from each slide with a razor blade and placed into separate jars. The contents of each jar are identified according to species composition and relative abundance.

2.5.2.4.2 Results

Periphyton data are presented in Tables 2.5.2-10 through -14 as species lists, density and diversity.

The diatoms (Bacillariophyta), represented by 131 taxa, were the major component of the algal collections. The green algae (Chlorophyta) were represented by 10 taxa, blue-green algae (Cyanophyta) represented by 7 taxa, and euglenoids (Euglenophyta) represented by 4 taxa.

During 1982, the diatoms were also the most abundant periphyton in all samples and accounted for 76 to 100% of the total mean periphyton density. The diatoms that dominated the periphyton of Piceance Creek in 1982 have similar known ecological requirements and tolerance. They attain best development in alkaline waters and are common in oligotrophic to mesotrophic (slightly to moderately organically enriched) rivers and streams of this region (Lowe 1974; Patrick and Reimer 1966).

PERIPHYTON DATA

PERIPHYTON DATA

TABLE 2.5.2-10

PERIPHYTON SPECIES LIST

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK
1982

TAXON	STATION NUMBER WP01	WP02	WP03
BACILLARIOPHYTA			
ACHNANTHES LANCEOLATA	X	X	X
ACHNANTHES LANCEOLATA VAR. DUBIA	X	X	X
ACHNANTHES LINEARIS	X	X	X
ACHNANTHES MINUTISSIMA	X	X	X
AMPHORA OVALIS	X	X	X
AMPHORA OVALIS VAR. AFFINIS	X	X	X
AMPHORA OVALIS VAR. PEDICULUS			X
AMPHORA PERPUSILLA	X	X	X
AMPHORA VENETA	X	X	
CALONEIS AMPHISBAENA	X	X	X
CALONEIS SP.		X	
CALONEIS VENTRICOSA VAR. MINUTA	X		
COCCONEIS PEDICULUS	X	X	X
COCCONEIS PLACENTULA	X		
COCCONEIS PLACENTULA VAR. EUGLYPTA	X	X	X
COCCONEIS PLACENTULA VAR. LINEATA	X	X	X
CYCLOTELLA KUTZINGIANA		X	
CYCLOTELLA MENEGHINIANA	X	X	X
CYMATOPLEURA SOLEA	X		X
CYMBELLA AFFINIS	X	X	X
CYMBELLA ASPERA	X		
CYMBELLA CYMBIFORMIS		X	X
CYMBELLA LAEVIS		X	
CYMBELLA MUELLERI	X		
CYMBELLA MICROCEPHALA		X	
CYMBELLA MINUTA	X		
CYMBELLA MINUTA VAR. SILESIACA	X	X	X
CYMBELLA SINUATA	X	X	X
DENTICULA ELEGANS	X		X
DENTICULA SP.		X	
DIATOMA TENUE		X	
DIATOMA TENUE VAR. ELONGATUM	X	X	X
DIATOMA VULGARE	X	X	X
ENTOMONEIS ORNATA			X
EPITHEMIA SOREX	X		
FRAGILARIA CONSTRUENS		X	
FRAGILAREA CONSTRUENS VAR. BINODIS	X	X	X
FRAGILARIA CONSTRUENS VAR. VENTER	X	X	X
FRAGILARIA CROTONENSIS	X		
FRAGILARIA LEPTOSTAURON	X	X	X
FRAGILARIA VAUCHERIAE	X	X	X
FRUSTULIA RHOMBOIDES		X	X
GOMPHONEMA ANGUSTATUM		X	X
GOMPHONEMA GRACILE	X		
GOMPHONEMA INTRICATUM			X
GOMPHONEMA OLIVACEUM	X	X	X
GOMPHONEMA PARVULUM	X	X	X
GOMPHONEMA SUBCLAVATUM	X	X	X
GOMPHONEMA TENELLUM	X	X	X
GOMPHONEMA SP.	X	X	X

GYROSIGMA SPENCERII	X	X	X
HANTZSCHIA AMPHIOXYS	X	X	X
MASTOGLOIA SPP.			X
MERIDION CIRCULARE	X	X	
MERIDION CIRCULARE VAR. CONSTRICTUM		X	
NAVICULA ARVENSIS	X	X	X
NAVICULA CINCTA		X	
NAVICULA CRYPTOCEPHALA	X	X	
NAVICULA CRYPTOCEPHALA VAR. VENETA	X	X	X
NAVICULA CUSPIDATA		X	X
NAVICULA HEUFLERI	X	X	X
NAVICULA LANCEOLATA VAR. DUBIA			X
NAVICULA LUZONENSIS			X
NAVICULA MINIMA	X	X	X
NAVICULA MINUSCULA	X		
NAVICULA MUTICA	X	X	X
NAVICULA MUTICA VAR. UNDULATA	X	X	X
NAVICULA NOTHA	X	X	X
NAVICULA PELLICULOSA	X		
NAVICULA PUPULA		X	X
NAVICULA PUPULA VAR. CAPITATA		X	X
NAVICULA PUPULA VAR. RECTANGULARIS	X		
NAVICULA PROTRACTA			X
NAVICULA PYGMAEA			X
NAVICULA RADIOSA		X	
NAVICULA RHYNCHOCEPHALA	X	X	
NAVICULA SALINARUM VAR. INTERMEDIA	X	X	X
NAVICULA SECRETA VAR. APICULATA	X	X	X
NAVICULA TRIPUNCTATA	X	X	
NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	X	X	X
NAVICULA VIRIDULA		X	
NAVICULA VIRIDULA VAR. AVENACEA	X	X	X
NAVICULA SP.	X	X	X
NITZSCHIA ACICULARIS	X	X	X
NITZSCHIA AMPHIBIA	X	X	
NITZSCHIA APICULATA	X	X	X
NITZSCHIA CAPITELLATA	X	X	
NITZSCHIA COMMUNIS	X	X	
NITZSCHIA DENTICULA	X		
NITZSCHIA DISSIPATA	X	X	X
NITZSCHIA FONTICOLA	X	X	X
NITZSCHIA FRUSTULUM	X	X	X
NITZSCHIA GRACILIS		X	
NITZSCHIA HUNGARICA	X	X	X
NITZSCHIA IGNORATA	X	X	
NITZSCHIA KUTZINGIANA	X		
NITZSCHIA LINEARIS	X	X	X
NITZSCHIA PALEACEA	X	X	X
NITZSCHIA PALEA	X	X	X
NITZSCHIA RECTA		X	
NITZSCHIA SIGMOIDEA	X	X	X
NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS	X	X	X
NITZSCHIA SP.	X	X	X
PINNULARIA BREBISSONII		X	X
PINNULARIA MICROSTAURON		X	
PINNULARIA VIRIDIS VAR. MINOR			X
PINNULARIA SP.			X
RHOICOSPHENIA CURVATA	X	X	X
RHOPALODIA GIBBA VAR. VENTRICOSA		X	X
RHOPALODIA MUSCULUS	X	X	X
SKELETONEMA POTAMOS	X		
STAURONEIS ANCEPS			X
STAURONEIS SMITHII		X	
STEPHANODISCUS SP.	X		X

STEPHANODISCUS TENUIS		X	
SURIRELLA ANGUSTATA		X	
SURIRELLA OVALIS	X	X	X
SURIRELLA OVATA	X	X	X
SYNEDRA ACUS	X	X	X
SYNEDRA AMPHICEPHALA	X	X	X
SYNEDRA DELICATISSIMA	X	X	X
SYNEDRA FASCICULATA	X	X	X
SYNEDRA FASCICULATA VAR. TRUNCATA	X	X	
SYNEDRA MINUSCULA	X	X	
SYNEDRA PULCHELLA	X	X	X
SYNEDRA RUMPENS VAR. FAMILIARIS		X	
SYNEDRA ULNA	X	X	X
SYNEDRA ULNA VAR. DANICA		X	
SYNEDRA SP.		X	
THALASSIOSIRA FLUVIATILIS	X	X	X
UNIDENTIFIED PENNATE DIATOMS	X	X	X
CHLOROPHYTA			
ANKISTRODESMUS SP.		X	
CHLAMYDOMONAS SP.	X	X	X
CLOSTERIUM SP.	X	X	
COELASTRUM SP.		X	
UNIDENTIFIED GREEN COCCOID		X	
MOUGEOTIA SP.	X	X	
OEDOGONIUM SP.	X		X
STIGEOCLONIUM TENUE	X	X	X
TETRAEDRON MINIMUM	X		
UNIDENTIFIED FILAMENT	X		X
CHRYSOPHYTA			
CYANOPHYTA			
ANABAENA SP.	X	X	X
CHROOCOCCUS SP.	X		X
LYNGBYA SP.	X	X	X
MERISMOPEDEA SP.		X	
OSCILLATORIA TENVIS	X	X	X
OSCILLATORIA SP.	X	X	X
PHORMIDIUM SP.	X	X	
EUGLENOPHYTA			
EUGLENA ACUS	X		
EUGLENA SP.		X	
PHACUS SP.	X	X	
TRACHELOMONAS SP.		X	
RHODOPHYTA			

X = ORGANISM IDENTIFIED TO THIS TAXONOMIC LEVEL OBSERVED AT SAMPLING STATION

PERIPHYTON SPECIES LIST

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SPECIES OCCURRENCE BY SAMPLING DATE AT STATION WP01
1982

TAXON	SAMPLING DATE					
	MAY	JUNE	JULY	AUG	SEPT	OCT
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA						X
ACHNANTHES LANCEOLATA VAR. DUBIA	X	X	X	X	X	X
ACHNANTHES LINEARIS	X	X	X	X		X
ACHNANTHES MINUTISSIMA	X	X	X	X	X	X
AMPHORA OVALIS	X					
AMPHORA OVALIS VAR. AFFINIS						X
AMPHORA PERPUSILLA	X	X	X	X	X	X
AMPHORA VENETA						X
CALONEIS AMPHISBAENA		X	X			
CALONEIS VENTRICOSA VAR. MINUTA			X			
COCCONEIS PEDICULUS		X	X	X		X
COCCONEIS PLACENTULA			X			
COCCONEIS PLACENTULA VAR. EUGLYPTA	X		X	X		
COCCONEIS PLACENTULA VAR. LINEATA	X	X	X	X	X	X
CYCLOTELLA MENEGHINIANA	X	X	X	X	X	X
CYMATOPLEURA SOLEA			X			
CYMBELLA AFFINIS			X	X	X	X
CYMBELLA ASPERA				X		
CYMBELLA MUELLERI				X		
CYMBELLA MINUTA	X	X				
CYMBELLA MINUTA VAR. SILESIACA	X		X	X	X	X
CYMBELLA SINUATA	X		X	X	X	X
DENTICULA ELEGANS		X				
DIATOMA TENUE VAR. ELONGATUM						X
DIATOMA VULGARE	X	X	X	X	X	X
EPITHEMIA SOREX	X					
FRAGILARIA CONSTRUENS VAR. BINODIS	X		X			X
FRAGILARIA CONSTRUENS VAR. VENTER			X			
FRAGILARIA CROTONENSIS	X	X				
FRAGILARIA LEPTOSTAURON	X					
FRAGILARIA VAUCHERIAE	X	X	X	X	X	X
GOMPHONEMA GRACILE					X	
GOMPHONEMA OLIVACEUM	X	X	X	X	X	X
GOMPHONEMA PARVULUM	X	X	X	X	X	X
GOMPHONEMA SUBCLAVATUM			X			X
GOMPHONEMA TENELLUM	X			X	X	X
GOMPHONEMA SP.				X	X	
GYROSIGMA SPENCERII	X					
HANTZSCHIA AMPHIOXYS	X		X	X		X
MERIDION CIRCULARE	X					
NAVICULA ARVENSIS	X			X	X	
NAVICULA CRYPTOCEPHALA		X	X	X		
NAVICULA CRYPTOCEPHALA VAR. VENETA	X	X	X	X	X	X
NAVICULA HEUFLERI				X	X	X
NAVICULA MINIMA			X	X	X	X
NAVICULA MINUSCULA		X				
NAVICULA MUTICA		X		X	X	X
NAVICULA MUTICA VAR. UNDULATA	X					X

NAVICULA NOTHA	X		X		X	X
NAVICULA PELLICULOSA	X			X		
NAVICULA PUPULA VAR. RECTANGULARIS	X					
NAVICULA RHYNCHOCEPHALA						X
NAVICULA SALINARUM VAR. INTERMEDIA				X	X	X
NAVICULA SECRETA VAR. APICULATA	X	X	X	X	X	X
NAVICULA TRIPUNCTATA						X
NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	X		X	X	X	X
NAVICULA VIRIDULA VAR. AVENACEA	X	X	X	X	X	X
NAVICULA SP.			X			
NITZSCHIA ACICULARIS	X	X				
NITZSCHIA AMPHIBIA	X	X		X		
NITZSCHIA APICULATA	X	X	X	X		X
NITZSCHIA CAPITELLATA		X	X			X
NITZSCHIA COMMUNIS		X	X			X
NITZSCHIA DENTICULA				X		
NITZSCHIA DISSIPATA	X	X	X	X	X	X
NITZSCHIA FONTICOLA	X	X	X	X		
NITZSCHIA FRUSTULUM	X	X	X	X	X	X
NITZSCHIA HUNGARICA			X	X		
NITZSCHIA IGNORATA	X			X		
NITZSCHIA KUTZINGIANA	X					
NITZSCHIA LINEARIS		X	X		X	X
NITZSCHIA PALEACEA		X	X			X
NITZSCHIA PALEA	X	X	X	X	X	X
NITZSCHIA SIGMOIDEA	X		X	X		X
NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS			X			
NITZSCHIA SP.	X	X	X	X		
RHOICOSPHENIA CURVATA	X	X	X	X	X	X
RHOPALODIA MUSCULUS		X	X			
SKELETONEMA POTAMOS	X					
STEPHANODISCUS SP.			X			
SURIRELLA OVALIS	X			X		
SURIRELLA OVATA	X	X	X	X	X	X
SYNEDRA ACUS		X	X	X		X
SYNEDRA AMPHICEPHALA	X	X	X			
SYNEDRA DELICATISSIMA			X		X	X
SYNEDRA FASCICULATA				X		
SYNEDRA FASCICULATA VAR. TRUNCATA				X		
SYNEDRA MINUSCULA				X		
SYNEDRA PULCHELLA				X		
SYNEDRA ULNA	X	X	X	X	X	
THALASSIOSIRA FLUVIATILIS		X	X			
UNIDENTIFIED PENNATE DIATOMS	X	X	X	X		
CHLOROPHYTA						
CHLAMYDOMONAS SP.			X			
CLOSTERIUM SP.		X				
MOUGEOTIA SP.			X	X		
OEDOGONIUM SP.			X			
STIGEOCLONIUM TENUE		X	X	X	X	
TETRAEDRON MINIMUM			X			
UNIDENTIFIED FILAMENT	X			X		
CHRYSOPHYTA						
CYANOPHYTA						
ANABAENA SP.		X	X	X		X
CHROOCOCCUS SP.				X		
LYNGBYA SP.			X	X		X
OSCILLATORIA TENVIS		X	X		X	

USCILLATORIA SP.		X	
PHORMIDIUM SP.	X	X	X
EUGLENOPHYTA			
EUGLENA ACUS	X		
PHACUS SP.		X	
RHODOPHYTA			

X = ORGANISM IDENTIFIED TO THIS TAXONOMIC LEVEL OBSERVED AT SAMPLING STATION

PERIPHYTON SPECIES LIST

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SPECIES OCCURRENCE BY SAMPLING DATE AT STATION WPO2
1982

TAXON	SAMPLING DATE MAY	JUNE	JULY	AUG	SEPT	OCT
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA	X		X		X	
ACHNANTHES LANCEOLATA VAR. DUBIA	X	X	X	X	X	X
ACHNANTHES LINEARIS	X	X	X	X	X	
ACHNANTHES MINUTISSIMA	X	X	X	X	X	X
AMPHORA OVALIS	X			X	X	
AMPHORA OVALIS VAR. AFFINIS				X		
AMPHORA PERPUSILLA	X	X	X	X	X	X
AMPHORA VENETA			X			
CALONEIS AMPHISBAENA	X	X				
CALONEIS SP.		X	X			
COCCONEIS PEDICULUS	X	X		X	X	X
COCCONEIS PLACENTULA VAR. EUGLYPTA				X		X
COCCONEIS PLACENTULA VAR. LINEATA	X	X	X	X	X	X
CYCLOTELLA KUTZINGIANA	X					
CYCLOTELLA MENEGHINIANA	X	X	X	X	X	X
CYMBELLA AFFINIS	X	X		X	X	X
CYMBELLA CYMBIFORMIS				X	X	
CYMBELLA LAEVIS		X				
CYMBELLA MICROCEPHALA	X					
CYMBELLA MINUTA VAR. SILESIACA	X	X	X	X	X	X
CYMBELLA SINUATA			X	X	X	X
DENTICULA SP.		X				
DIATOMA TENUE		X				
DIATOMA TENUE VAR. ELONGATUM	X	X		X		
DIATOMA VULGARE	X	X	X	X	X	X
FRAGILARIA CONSTRUENS						X
FRAGILAREA CONSTRUENS VAR. BINODIS	X	X	X		X	
FRAGILARIA CONSTRUENS VAR. VENTER		X			X	
FRAGILARIA LEPTOSTAURON	X	X		X	X	X
FRAGILARIA VAUCHERIAE	X	X	X	X	X	X
FRUSTULIA RHOMBOIDES					X	
GOMPHONEMA ANGUSTATUM	X					
GOMPHONEMA OLIVACEUM	X	X	X	X	X	X
GOMPHONEMA PARVULUM	X	X	X	X	X	X
GOMPHONEMA SUBCLAVATUM			X	X		X
GOMPHONEMA TENELLUM	X				X	X
GOMPHONEMA SP.	X			X		
GYROSIGMA SPENCERII		X		X	X	
HANTZSCHIA AMPHIOXYS	X		X	X	X	X
MERIDION CIRCULARE	X					
MERIDION CIRCULARE VAR. CONSTRICTUM		X				
NAVICULA ARVENSIS	X			X	X	X
NAVICULA CINCTA	X					
NAVICULA CRYPTOCEPHALA		X	X	X		
NAVICULA CRYPTOCEPHALA VAR. VENETA	X	X	X	X	X	X
NAVICULA CUSPIDATA			X	X		
NAVICULA HEUFLERI				X	X	X
NAVICULA MINIMA			X	X	X	X

NAVICULA MUTICA	X			X	X	
NAVICULA MUTICA VAR. UNDULATA		X		X	X	
NAVICULA NOTHA	X		X	X	X	X
NAVICULA PUPULA				X	X	
NAVICULA PUPULA VAR. CAPITATA		X				
NAVICULA RADIOSA	X					
NAVICULA RHYNCHOCEPHALA	X	X		X		
NAVICULA SALINARUM VAR. INTERMEDIA				X	X	X
NAVICULA SECRETA VAR. APICULATA	X	X	X	X	X	X
NAVICULA TRIPUNCTATA						X
NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	X	X	X	X	X	X
NAVICULA VIRIDULA			X			
NAVICULA VIRIDULA VAR. AVENACEA	X	X	X	X	X	X
NAVICULA SP.				X		
NITZSCHIA ACICULARIS	X				X	
NITZSCHIA AMPHIBIA				X	X	
NITZSCHIA APICULATA		X	X	X	X	X
NITZSCHIA CAPITELLATA	X	X	X			X
NITZSCHIA COMMUNIS	X		X			
NITZSCHIA DISSIPATA	X	X	X	X	X	X
NITZSCHIA FONTICOLA	X	X	X	X	X	
NITZSCHIA FRUSTULUM	X	X	X	X	X	X
NITZSCHIA GRACILIS		X				X
NITZSCHIA HUNGARICA		X				
NITZSCHIA IGNORATA						X
NITZSCHIA LINEARIS	X	X	X		X	X
NITZSCHIA PALEACEA		X	X			
NITZSCHIA PALEA	X	X	X	X	X	X
NITZSCHIA RECTA	X					
NITZSCHIA SIGMOIDEA		X	X		X	
NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS		X	X	X		X
NITZSCHIA SP.	X	X	X	X	X	X
PINNULARIA BREBISSONII	X			X	X	
PINNULARIA MICROSTAURON		X				
RHOICOSPHENIA CURVATA	X	X	X	X	X	X
RHOPALODIA GIBBA VAR. VENTRICOSA	X	X				
RHOPALODIA MUSCULUS		X	X			
STAURONEIS SMITHII					X	
STEPHANODISCUS TENUIS	X					
SURIRELLA ANGUSTATA					X	
SURIRELLA OVALIS	X	X		X		
SURIRELLA OVATA	X	X	X	X	X	X
SYNEDRA ACUS		X				X
SYNEDRA AMPHICEPHALA	X	X				
SYNEDRA DELICATISSIMA	X		X	X		X
SYNEDRA FASCICULATA				X	X	
SYNEDRA FASCICULATA VAR. TRUNCATA			X			
SYNEDRA MINUSCULA				X		
SYNEDRA PULCHELLA				X		
SYNEDRA RUMPENS VAR. FAMILIARIS				X		
SYNEDRA ULNA	X	X	X	X	X	X
SYNEDRA ULNA VAR. DANICA		X				
SYNEDRA SP.				X	X	
THALASSIOSIRA FLUVIATILIS		X	X	X		X
UNIDENTIFIED PENNATE DIATOMS	X	X	X	X	X	X
CHLOROPHYTA						
ANKISTRODESMUS SP.			X			
CHLAMYDOMONAS SP.		X	X			
CLOSTERIUM SP.				X		
COELASTRUM SP.		X				
UNIDENTIFIED GREEN COCCOID	X	X				
MOUGEOTIA SP.			X			

STIGEOCLONIUM TENUE		X	X	X		
CHRYSOPHYTA						
CYANOPHYTA						
ANABAENA SP.	X		X	X		
LYNGBYA SP.				X	X	X
MERISMOPEDEA SP.				X		
OSCILLATORIA TENVIS		X		X		
OSCILLATORIA SP.		X	X		X	
PHORMIDIUM SP.		X	X			
EUGLENOPHYTA						
EUGLENA SP.		X			X	
PHACUS SP.		X				
TRACHELOMONAS SP.			X			
RHODOPHYTA						

X = ORGANISM IDENTIFIED TO THIS TAXONOMIC LEVEL OBSERVED AT SAMPLING STATION

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SPECIES OCCURRENCE BY SAMPLING DATE AT STATION WP03
1982

TAXON	SAMPLING DATE					
	MAY	JUNE	JULY	AUG	SEPT	OCT
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA	X	X				X
ACHNANTHES LANCEOLATA VAR. DUBIA	X	X		X	X	X
ACHNANTHES LINEARIS	X	X				
ACHNANTHES MINUTISSIMA	X	X			X	X
AMPHORA OVALIS	X					
AMPHORA OVALIS VAR. AFFINIS					X	X
AMPHORA OVALIS VAR. PEDICULUS		X				
AMPHORA PERPUSILLA	X	X			X	X
CALONEIS AMPHISBAENA	X	X				
COCCONEIS PEDICULUS	X	X		X		
COCCONEIS PLACENTULA VAR. EUGLYPTA				X		
COCCONEIS PLACENTULA VAR. LINEATA	X	X		X	X	X
CYCLOTELLA MENEGHINIANA	X	X			X	X
CYMATOPLEURA SOLEA		X				
CYMBELLA AFFINIS	X	X		X	X	X
CYMBELLA CYMBIFORMIS						X
CYMBELLA MINUTA VAR. SILESIACA	X	X			X	X
CYMBELLA SINUATA	X					X
DENTICULA ELEGANS					X	
DIATOMA TENUE VAR. ELONGATUM				X		X
DIATOMA VULGARE	X	X		X	X	X
ENTOMONEIS ORNATA					X	
FRAGILAREA CONSTRUENS VAR. BINODIS					X	
FRAGILARIA CONSTRUENS VAR. VENTER	X					
FRAGILARIA LEPTOSTAURON		X			X	X
FRAGILARIA VAUCHERIAE	X	X		X	X	X
FRUSTULIA RHOMBOIDES					X	
GOMPHONEMA ANGUSTATUM		X				
GOMPHONEMA INTRICATUM				X		
GOMPHONEMA OLIVACEUM	X			X	X	X
GOMPHONEMA PARVULUM	X	X		X	X	X
GOMPHONEMA SUBCLAVATUM	X	X		X		X
GOMPHONEMA TENELLUM				X	X	X
GOMPHONEMA SP.		X			X	
GYROSIGMA SPENCERII		X				
HANTZSCHIA AMPHIOXYS	X	X			X	
MASTOGLOIA SPP.						X
NAVICULA ARVENSIS		X		X	X	
NAVICULA CRYPTOCEPHALA VAR. VENETA	X	X		X	X	X
NAVICULA CUSPIDATA		X				
NAVICULA HEUFLERI	X	X		X	X	X
NAVICULA LANCEOLATA VAR. DUBIA						X
NAVICULA LUZONENSIS		X				
NAVICULA MINIMA		X			X	X
NAVICULA MUTICA		X			X	X
NAVICULA MUTICA VAR. UNDULATA					X	
NAVICULA NOTHA	X				X	X
NAVICULA PUPULA		X			X	X

NAVICULA PUPULA VAR. CAPITATA				X	
NAVICULA PROTRACTA		X			
NAVICULA PYGMAEA	X				
NAVICULA SALINARUM VAR. INTERMEDIA				X	X
NAVICULA SECRETA VAR. APICULATA	X	X	X	X	X
NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	X			X	X
NAVICULA VIRIDULA VAR. AVENACEA	X	X	X	X	X
NAVICULA SP.					X
NITZSCHIA ACICULARIS	X				
NITZSCHIA APICULATA	X	X	X	X	X
NITZSCHIA DISSIPATA	X	X	X	X	X
NITZSCHIA FONTICOLA	X	X	X		
NITZSCHIA FRUSTULUM	X	X	X	X	X
NITZSCHIA HUNGARICA	X	X		X	X
NITZSCHIA LINEARIS	X	X			
NITZSCHIA PALEACEA		X			
NITZSCHIA PALEA	X	X			X
NITZSCHIA SIGMOIDEA		X			X
NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS		X	X		
NITZSCHIA SP.	X	X		X	
PINNULARIA BREBISSONII				X	X
PINNULARIA VIRIDIS VAR. MINOR		X			
PINNULARIA SP.		X			
RHOICOSPHENIA CURVATA	X	X	X	X	X
RHOPALODIA GIBBA VAR. VENTRICOSA		X			
RHOPALODIA MUSCULUS		X		X	X
STAURONEIS ANICEPS				X	
STEPHANODISCUS SP.				X	X
SURIRELLA OVALIS	X	X			
SURIRELLA OVATA	X	X	X	X	X
SYNEDRA ACUS				X	X
SYNEDRA AMPHICEPHALA	X				X
SYNEDRA DELICATISSIMA		X			
SYNEDRA FASCICULATA	X				
SYNEDRA PULCHELLA		X		X	
SYNEDRA ULNA	X	X		X	X
THALASSIOSIRA FLUVIATILIS	X	X		X	
UNIDENTIFIED PENNATE DIATOMS		X		X	X
CHLOROPHYTA					
CHLAMYDOMONAS SP.			X		
OEDOGONIUM SP.			X		
STIGEOCLONIUM TENUE		X	X	X	
UNIDENTIFIED FILAMENT	X				
CHRYSOPHYTA					
CYANOPHYTA					
ANABAENA SP.			X		X
CHROOCOCCUS SP.			X		
LYNGBYA SP.			X		
OSCILLATORIA TENVIS		X			
OSCILLATORIA SP.		X			
EUGLENOPHYTA					
RHODOPHYTA					

X = ORGANISM IDENTIFIED TO THIS TAXONOMIC LEVEL OBSERVED AT SAMPLING STATION

TABLE 2.5.2-11

PERIPHYTON BENCH SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 06-01-82

C - 592 V - 110 ML DF - 1:0 L - 50 MM W - .33 MM D - 1 MM S - .5 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA1 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED NON-DIATOMS SEDGWICK-RAFTER COUNT
1SKPOT	SKELETONEMA POTAMOS	4	
1NAARV	NAVICULA ARVENSIS	1	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	108	
1COCPU	COCCONEIS PLACENTULA VAR. EUGLYPTA	2	
1ACMIN	ACHNANTHES MINUTISSIMA	30	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	P	
1NIDIS	NITZSCHIA DISSIPATA	5	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	6	
1SUOVA	SURIRELLA OVATA	5	
1RHCUR	RHOICOSPHENIA CURVATA	9	
1CYCME	CYCLOTELLA MENEGHINIANA	P	
1NANOT	NAVICULA NOTHA	P	
1NIPAL	NITZSCHIA PALEA	4	
1NASEA	NAVICULA SECRETA VAR. APICULATA	6	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	1	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	5	
1NIFRU	NITZSCHIA FRUSTULUM	1	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	2	
1NISPP	NITZSCHIA SP.	4	
1FRAVA	FRAGILARIA VAUCHERIAE	1	
1NIFON	NITZSCHIA FONTICOLA	1	
1FRACR	FRAGILARIA CROTONENSIS	2	
1CYMSI	CYMBELLA SINUATA	2	
1NIAPI	NITZSCHIA APICULATA	3	
1SYAMP	SYNEDRA AMPHICEPHALA	2	
1DIVUL	DIATOMA VULGARE	P	
1GYSPE	GYROSIGMA SPENCERII	P	
1MERCI	MERIDION CIRCULARE	P	
1SYULN	SYNEDRA ULNA	P	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	P	
1AMPER	AMPHORA PERPUSILLA	P	
1NISIE	NITZSCHIA SIGMOIDEA	P	
1FRACB	FRAGILAREA CONSTRUENS VAR. BINODIS	P	
1SUOVL	SURIRELLA OVALIS	P	
1NAMUU	NAVICULA MUTICA VAR. UNDULATA	P	
1EPSOR	EPITHEMIA SOREX	P	
1FRALE	FRAGILARIA LEPTOSTAURON	P	
1ACLIN	ACHNANTHES LINEARIS	P	

SAMPLE STATION: WPO1 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 06-01-82

C - 1089   V - 110 ML   DF - 1:0   L - 50 MM   W - .17 MM   D - 1 MM   S - 1   A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 159-PA2   ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1FRAVA	FRAGILARIA VAUCHERIAE	P	
1SUOVA	SURIRELLA OVATA	3	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	125	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	1	
1GOPAR	GOMPHONEMA PARVULUM	4	
1ACMIN	ACHNANTHES MINUTISSIMA	21	
1FRAVA	FRAGILARIA VAUCHERIAE	2	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	4	
1NIDIS	NITZSCHIA DISSIPATA	7	
1NIFON	NITZSCHIA FONTICOLA	2	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	3	
1CYMMI	CYMBELLA MINUTA	1	
1CYMSI	CYMBELLA SINUATA	2	
1NACPV	NAVICULA CRYPTOCEPHALA VAR. VENETA	4	
1NAPUR	NAVICULA PUPULA VAR. RECTANGULARIS	1	
1NANOT	NAVICULA NOTHA	1	
1NAPEL	NAVICULA PELLICULOSA	2	
1NIPAL	NITZSCHIA PALEA	5	
1RHCUR	RHOICOSPHENIA CURVATA	1	
1NISPP	NITZSCHIA SP.	2	
1NIIGN	NITZSCHIA IGNORATA	1	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	4	
1NIFRU	NITZSCHIA FRUSTULUM	3	
1NASEA	NAVICULA SECRETA VAR. APICULATA	2	
1GYSPE	GYROSIGMA SPENCERII	P	
1CYCME	CYCLOTELLA MENEGHINIANA	P	

SAMPLE STATION: WPO1 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 06-01-82

C - 1207   V - 110 ML   DF - 1:0   L - 50 MM   W - .17 MM   D - 1 MM   S - 1   A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 159-PA3   ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
2UNFIL	UNIDENTIFIED FILAMENT		3
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	150	
1SUOVA	SURIRELLA OVATA	3	
1GOOLI	GOMPHONEMA OLIVACEUM	5	
1ACMIN	ACHNANTHES MINUTISSIMA	30	
1RHCUR	RHOICOSPHENIA CURVATA	12	
1SYULN	SYNEDRA ULNA	P	
1GOPAR	GOMPHONEMA PARVULUM	P	
1AMOVP	AMPHORA OVALIS	P	
1NIDIS	NITZSCHIA DISSIPATA	5	
1DIVUL	DIATOMA VULGARE	1	
1SYAMP	SYNEDRA AMPHICEPHALA	1	
1NIFON	NITZSCHIA FONTICOLA	4	
1NIPAL	NITZSCHIA PALEA	5	
1FRAVA	FRAGILARIA VAUCHERIAE	1	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	3	
1ACLIN	ACHNANTHES LINEARIS	2	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	1	
1CYMSI	CYMBELLA SINUATA	4	
1NIACI	NITZSCHIA ACICULARIS	P	
1MERCI	MERIDION CIRCULARE	1	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	3	
1NIAMP	NITZSCHIA AMPHIBIA	3	
1NASEA	NAVICULA SECRETA VAR. APICULATA	10	
1NISPP	NITZSCHIA SP.	5	
1COCPU	COCCONEIS PLACENTULA VAR. EUGLYPTA	1	
1NIKUT	NITZSCHIA KUTZINGIANA	1	
1AMPER	AMPHORA PERPUSILLA	1	
1GOTEN	GOMPHONEMA TENELLUM	2	
1HANAM	HANTZSCHIA AMPHIOXYS	P	

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 06-01-82

C - 564   V - 110 ML   DF - 1:19   L - 50 MM   W - .33 MM   D - 1 MM   S - 1   A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA4   ANALYST - FHB

NUMBER COUNTED

TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	2	
1NAVIA	NAVICULA VERIDULA VAR. AVENACEA	101	
1SUOVA	SURIRELLA OVATA	5	
1CYCME	CYCLOTELLA MENEGHINIANA	4	
1NIDIS	NITZSCHIA DISSIPATA	17	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	3	
1NASEA	NAVICULA SECRETA VAR. APICULATA	5	
1COCPE	COCCONEIS PEDICULUS	P	
1NIREC	NITZSCHIA RECTA	P	
1ACLIN	ACHNANTHES LINEARIS	2	
1NIFON	NITZSCHIA FONTICOLA	4	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	2	
1GOOLI	GOMPHONEMA OLIVACEUM	P	
1ACMIN	ACHNANTHES MINUTISSIMA	11	
1NAMUT	NAVICULA MUTICA	P	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	7	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	3	
1AMPER	AMPHORA PERPUSILLA	2	
1SYAMP	SYNEDRA AMPHICEPHALA	1	
1NISPP	NITZSCHIA SP.	2	
1NACIN	NAVICULA CINCTA	2	
1NISPP	NITZSCHIA SP.	3	
1NAARV	NAVICULA ARVENSIS	2	
1RHCUR	RHOICOSPHENIA CURVATA	2	
1GOANG	GOMPHONEMA ANGUSTATUM	1	
1NIACI	NITZSCHIA ACICULARIS	2	
1FRACB	FRAGILAREA CONSTRUENS VAR. BINODIS	7	
1SYDEL	SYNEDRA DELICATISSIMA	1	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	2	
1FRALE	FRAGILARIA LEPTOSTAURON	P	
1MERCI	MERIDION CIRCULARE	P	
1SYULN	SYNEDRA ULNA	P	
1AMOVP	AMPHORA OVALIS	P	
1PIBRE	PINNULARIA BREBISSONII	P	
1RHGIN	RHOPALODIA GIBBA VAR. VENTRICOSA	P	

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 06-01-82

C - 442 V - 110 ML DF - 1:49 L - 50 MM W - .33 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA5 ANALYST - FHB

NUMBER COUNTED

DIATOMS NON-DIATOMS

TAXON CODE	TAXON	PROPORTIONAL COUNT	SEDGWICK-RAFTER COUNT
2GRCOC	UNIDENTIFIED GREEN COCCOID		1
4ANASP	ANABAENA SP.		1
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	6	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	112	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	7	
1ACMIN	ACHNANTHES MINUTISSIMA	18	
1ACLIN	ACHNANTHES LINEARIS	4	
1RHCUR	RHOICOSPHENIA CURVATA	6	
1NASEA	NAVICULA SECRETA VAR. APICULATA	6	
1NIFRU	NITZSCHIA FRUSTULUM	P	
1NIFON	NITZSCHIA FONTICOLA	3	
1NIPAL	NITZSCHIA PALEA	2	
1FRAVA	FRAGILARIA VAUCHERIAE	1	
1NIDIS	NITZSCHIA DISSIPATA	14	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	P	
1CYMMC	CYMBELLA MICROCEPHALA	2	
1SUOVA	SURIRELLA OVATA	3	
1CYCME	CYCLOTELLA MENEGHINIANA	1	
1NANOT	NAVICULA NOTHA	P	
1AMPER	AMPHORA PERPUSILLA	P	
1NACIN	NAVICULA CINCTA	2	
1NISPP	NITZSCHIA SP.	2	
1GOOLI	GOMPHONEMA OLIVACEUM	P	
1SYAMP	SYNEDRA AMPHICEPHALA	P	
1CYCKU	CYCLOTELLA KUTZINGIANA	P	
1HANAM	HANTZSCHIA AMPHIOXYS	P	
1NICAP	NITZSCHIA CAPITELLATA	1	
1GOTEN	GOMPHONEMA TENELLUM	1	
1CYMAF	CYMBELLA AFFINIS	1	
1ACLAN	ACHNANTHES LANCEOLATA	1	
1GOSPP	GOMPHONEMA SP.	1	
1STTEN	STEPHANODISCUS TENUIS	P	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	2	
1NICOM	NITZSCHIA COMMUNIS	1	
1NARAD	NAVICULA RADIOSA	2	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	1	
1CAAMP	CALONEIS AMPHISBAENA	2	
1NIACI	NITZSCHIA ACICULARIS	2	
1DIVUL	DIATOMA VULGARE	P	
1SUOVL	SURIRELLA OVALIS	P	

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 06-01-82

C - 489 V - 110 ML DF - 1:49 L - 50 MM W - .33 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA6 ANALYST - FHB

NUMBER COUNTED

TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
4ANASP	ANABAENA SP.		1
1NIDIS	NITZSCHIA DISSIPATA	18	
1NAARV	NAVICULA ARVENSIS	2	
1MERCI	MERIDION CIRCULARE	P	
1SUOVA	SURIRELLA OVATA	2	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	106	
1ACMIN	ACHNANTHES MINUTISSIMA	32	
1NIFRU	NITZSCHIA FRUSTULUM	3	
1FRAVA	FRAGILARIA VAUCHERIAE	1	
1NIFON	NITZSCHIA FONTICOLA	4	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	6	
1NISPP	NITZSCHIA SP.	10	
1NASEA	NAVICULA SECRETA VAR. APICULATA	6	
1SYDEL	SYNEDRA DELICATISSIMA	P	
1CYCME	CYCLOTELLA MENEGHINIANA	4	
1HANAM	HANTZSCHIA AMPHIOXYS	P	
1GOTEN	GOMPHONEMA TENELLUM	P	
1RHCUR	RHOICOSPHENIA CURVATA	6	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	2	
1AMPER	AMPHORA PERPUSILLA	8	
1ACLIN	ACHNANTHES LINEARIS	8	
1NACIN	NAVICULA CINCTA	3	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	1	
1NIPAL	NITZSCHIA PALEA	4	
1SYAMP	SYNEDRA AMPHICEPHALA	2	
1NARHY	NAVICULA RHYNCHOCEPHALA	1	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	7	
1NILIN	NITZSCHIA LINEARIS	2	
1NICOM	NITZSCHIA COMMUNIS	2	
1RHGIN	RHOPALODIA GIBBA VAR. VENTRICOSA	P	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	P	
1GOOLI	GOMPHONEMA OLIVACEUM	P	
1SUOVL	SURIRELLA OVALIS	P	
1NAMUT	NAVICULA MUTICA	P	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	P	
1FRALE	FRAGILARIA LEPTOSTAURON	P	
1GOPAR	GOMPHONEMA PARVULUM	P	
1CYMAF	CYMBELLA AFFINIS	P	
1DITEE	DIATOMA TENUE VAR. ELONGATUM	P	
1SYULN	SYNEDRA ULNA	P	

SAMPLE STATION: WPO3 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 06-01-82

C - 343   V - 110 ML   DF - 1:49   L - 50 MM   W - .33 MM   D - 1 MM   S - 2   A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA7   ANALYST - FHB

NUMBER COUNTED

TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
1COCPE	COCCONEIS PEDICULUS	P	
1NASEA	NAVICULA SECRETA VAR. APICULATA	8	
1SUOVA	SURIRELLA OVATA	1	
1NIHUN	NITZSCHIA HUNGARICA	P	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	P	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	7	
1NIFON	NITZSCHIA FONTICOLA	10	
1NILIN	NITZSCHIA LINEARIS	1	
1NIDIS	NITZSCHIA DISSIPATA	6	
1GOOLI	GOMPHONEMA OLIVACEUM	2	
1SYFAS	SYNEDRA FASCICULATA	P	
1NISPP	NITZSCHIA SP.	16	
1CYCME	CYCLOTELLA MENEGHINIANA	3	
1NANOT	NAVICULA NOTHA	2	
1SYULN	SYNEDRA ULNA	P	
1FRACV	FRAGILARIA CONSTRUENS VAR. VENTER	P	
1NIAPI	NITZSCHIA APICULATA	P	
1GOPAR	GOMPHONEMA PARVULUM	1	
1NIPAL	NITZSCHIA PALEA	18	
1NIACI	NITZSCHIA ACICULARIS	P	
1RHCUR	RHOICOSPHENIA CURVATA	5	
1ACMIN	ACHNANTHES MINUTISSIMA	7	
1SUOVL	SURIRELLA OVALIS	2	
1FRAVA	FRAGILARIA VAUCHERIAE	5	
1AMPER	AMPHORA PERPUSILLA	1	
1NIFRU	NITZSCHIA FRUSTULUM	2	
1SYAMP	SYNEDRA AMPHICEPHALA	1	
1THSPP	THALASSIOSIRA FLUVIATILIS	1	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	1	

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 06-01-82

C - 338 V - 110 ML DF - 1:49 L - 50 MM W - .33 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA8 ANALYST - FHB

NUMBER COUNTED

TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1HANAM	HANTZSCHIA AMPHIOXYS	P	

1ACLAN	ACHNANTHES LANCEOLATA	P
1NISPP	NITZSCHIA SP.	P
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	1
1RHCUR	RHOICOSPHENIA CURVATA	4
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	130
1GOPAR	GOMPHONEMA PARVULUM	2
1NIFON	NITZSCHIA FONTICOLA	14
1FRAVA	FRAGILARIA VAUCHERIAE	3
1ACMIN	ACHNANTHES MINUTISSIMA	8
1NIPAL	NITZSCHIA PALEA	36
1CYCME	CYCLOTELLA MENEGHINIANA	4
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	3
1NIFRU	NITZSCHIA FRUSTULUM	8
1SUOVA	SURIRELLA OVATA	11
1NIHUN	NITZSCHIA HUNGARICA	2
1NASEA	NAVICULA SECRETA VAR. APICULATA	4
1NANOT	NAVICULA NOTHA	1
1AMPER	AMPHORA PERPUSILLA	3
1ACLIN	ACHNANTHES LINEARIS	2
1SUOVL	SURIRELLA OVALIS	P
1NISPP	NITZSCHIA SP.	3
1NIDIS	NITZSCHIA DISSIPATA	4
1NAHEU	NAVICULA HEUFLERI	1
1NILIN	NITZSCHIA LINEARIS	2
1AMOVP	AMPHORA OVALIS	1
1SYAMP	SYNEDRA AMPHICEPHALA	P
1GOOLI	GOMPHONEMA OLIVACEUM	1
1CYMAF	CYMBELLA AFFINIS	1
1GOSUB	GOMPHONEMA SUBCLAVATUM	2
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	P
1NAPYG	NAVICULA PYGMAEA	P
1NIACI	NITZSCHIA ACICULARIS	P
1NIAPI	NITZSCHIA APICULATA	P

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 06-01-82

C - 301 V - 110 ML DF - 1:49 L - 50 MM W - .33 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA9 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
2UNFIL	UNIDENTIFIED FILAMENT		1
1NASEA	NAVICULA SECRETA VAR. APICULATA	6	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
1NIPAL	NITZSCHIA PALEA	33	
1RHCUR	RHOICOSPHENIA CURVATA	3	

1NIDIS	NITZSCHIA DISSIPATA	2
1SUOVA	SURIRELLA OVATA	5
1FRAVA	FRAGILARIA VAUCHERIAE	P
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	3
1GOOLI	GOMPHONEMA OLIVACEUM	2
1NIFRU	NITZSCHIA FRUSTULUM	P
1CYCME	CYCLOTELLA MENEGHINIANA	2
1AMPER	AMPHORA PERPUSILLA	1
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	P
1SUOVL	SURIRELLA OVALIS	1
1NIHUN	NITZSCHIA HUNGARICA	2
1DIVUL	DIATOMA VULGARE	1
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	9
1GOPAR	GOMPHONEMA PARVULUM	3
1ACMIN	ACHNANTHES MINUTISSIMA	7
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	P
1NISPP	NITZSCHIA SP.	5
1NIAPI	NITZSCHIA APICULATA	1
1GOSUB	GOMPHONEMA SUBCLAVATUM	P
1NIFON	NITZSCHIA FONTICOLA	4
1NILIN	NITZSCHIA LINEARIS	P
1SYULN	SYNEDRA ULNA	1
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	2
1NAHEU	NAVICULA HEUFLERI	2
1CAAMP	CALONEIS AMPHISBAENA	1
1CYMSI	CYMBELLA SINUATA	2
1ACLIN	ACHNANTHES LINEARIS	2
1COCPE	COCCONEIS PEDICULUS	P
1AMOVP	AMPHORA OVALIS	P

PERIPHYTON BENCH SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WPO1 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 06-30-82

C - 246 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PALO ANALYST - FHB

		NUMBER COUNTED	
		DIATOMS	NON-DIATOMS
TAXON CODE	TAXON	PROPORTIONAL COUNT	SEDGWICK-RAFTER COUNT
1RHCUR	RHOICOSPHENIA CURVATA	20	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	99	
1ACMIN	ACHNANTHES MINUTISSIMA	27	
1AMPER	AMPHORA PERPUSILLA	2	
1NIDIS	NITZSCHIA DISSIPATA	6	
1GOOLI	GOMPHONEMA OLIVACEUM	10	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	4	
1SYULN	SYNEDRA ULNA	6	
1SYACU	SYNEDRA ACUS	10	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	1	
1NILIN	NITZSCHIA LINEARIS	4	
1NIFON	NITZSCHIA FONTICOLA	9	
1NASEA	NAVICULA SECRETA VAR. APICULATA	10	
1CYCME	CYCLOTELLA MENEGHINIANA	7	
1NIPAL	NITZSCHIA PALEA	4	
1NIFRU	NITZSCHIA FRUSTULUM	6	
1NICAP	NITZSCHIA CAPITELLATA	1	
1SYAMP	SYNEDRA AMPHICEPHALA	2	
1NAMIS	NAVICULA MINUSCULA	2	
1NIACI	NITZSCHIA ACICULARIS	2	
1THSPP	THALASSIOSIRA FLUVIATILIS	2	
1NIPAC	NITZXCHIA PALEACEA	1	
1NAMUT	NAVICULA MUTICA	1	
1NISPP	NITZSCHIA SP.	4	
1NACRY	NAVICULA CRYPTOCEPHALA	1	
1COCPE	COCCONEIS PEDICULUS	P	
4ANASP	ANABAENA SP.		P
4PHSPP	PHORMIDIUM SP.		P
1FRACR	FRAGILARIA CROTONENSIS	P	

SAMPLE STATION: WPO1 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 06-30-82

C - 420 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA11 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1SYACU	SYNEDRA ACUS	11	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	59	
1NIDIS	NITZSCHIA DISSIPATA	15	
1SYULN	SYNEDRA ULNA	9	
1NIFRU	NITZSCHIA FRUSTULUM	1	
1NIPAC	NITZXCHIA PALEACEA	10	
1RHCUR	RHOICOSPHENIA CURVATA	20	
1NIPAL	NITZSCHIA PALEA	6	
1NIACI	NITZSCHIA ACICULARIS	4	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	2	
1RHMUS	RHOPALODIA MUSCULUS	2	
1NASEA	NAVICULA SECRETA VAR. APICULATA	5	
1NISPP	NITZSCHIA SP.	10	
1ACMIN	ACHNANTHES MINUTISSIMA	14	
1NACRY	NAVICULA CRYPTOCEPHALA	2	
1GOOLI	GOMPHONEMA OLIVACEUM	16	
1FRAVA	FRAGILARIA VAUCHERIAE	3	
1NILIN	NITZSCHIA LINEARIS	2	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	5	
1NIFON	NITZSCHIA FONTICOLA	6	
1NICOM	NITZSCHIA COMMUNIS	1	
1NIAPI	NITZSCHIA APICULATA	4	
1DEELI	DENTICULA ELEGANS	2	
1SUOVA	SURIRELLA OVATA	P	
1CYCME	CYCLOTELLA MENEGHINIANA	P	
4PHSPP	PHORMIDIUM SP.		8
2STITE	STIGEOCLONIUM TENUE		9
4OSTEN	OSCILLATORIA TENVIS		7
1CYMMI	CYMBELLA MINUTA	P	
1GOPAR	GOMPHONEMA PARVULUM	P	
1DIVUL	DIATOMA VULGARE	P	
5EUACU	EUGLENA ACUS		P

SAMPLE STATION: WP01 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 06-30-82

C - 205 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA12   ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	50	
1SYULN	SYNEDRA ULNA	7	
1NICOM	NITZSCHIA COMMUNIS	4	
1NIACI	NITZSCHIA ACICULARIS	3	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	9	
1NIFPU	NITZSCHIA FRUSTULUM	2	
1NISPP	NITZSCHIA SP.	13	
1ACMIN	ACHNANTHES MINUTISSIMA	36	
1ACLIN	ACHNANTHES LINEARIS	2	
1SYACU	SYNEDRA ACUS	6	
1CYCME	CYCLOTELLA MENEGHINIANA	2	
1GOOLI	GOMPHONEMA OLIVACEUM	2	
1RHCUR	RHOICOSPHENIA CURVATA	17	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	5	
1NIPAC	NITZXCHIA PALEACEA	26	
1NASEA	NAVICULA SECRETA VAR. APICULATA	6	
1NILIN	NITZSCHIA LINEARIS	2	
1NICAP	NITZSCHIA CAPITELLATA	3	
1NIDIS	NITZSCHIA DISSIPATA	18	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	1	
1NIFON	NITZSCHIA FONTICOLA	15	
1NIAMP	NITZSCHIA AMPHIBIA	1	
1NIPAL	NITZSCHIA PALEA	3	
1FRAVA	FRAGILARIA VAUCHERIAE	3	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	P	
4OSTEN	OSCILLATORIA TENVIS		P
2CLOSP	CLOSTERIUM SP.		P
2STITE	STIGEOCLONIUM TENUE		9
4PHSPP	PHORMIDIUM SP.		6
4ANASP	ANABAENA SP.		1
1CAAMP	CALONEIS AMPHISBAENA	P	

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 05-30-82

C - 176   V - 100 ML   DF - 1:49   L - 50 MM   W - .561 MM   D - 1 MM   S - 3   A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA13   ANALYST - FHB

NUMBER COUNTED

TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	130	
1NIFRU	NITZSCHIA FRUSTULUM	13	
1THSPP	THALASSIOSIRA FLUVIATILIS	P	
1NASEA	NAVICULA SECRETA VAR. APICULATA	8	
1NILIN	NITZSCHIA LINEARIS	P	
1NIFON	NITZSCHIA FONTICOLA	6	
1NIDIS	NITZSCHIA DISSIPATA	8	
1FRACB	FRAGILAREA CONSTRUENS VAR. BINODIS	1	
1RHCUR	RHOICOSPHENIA CURVATA	10	
1CYCMF	CYCLOTELLA MENEGHINIANA	8	
1NISIE	NITZSCHIA SIGMOIDEA	3	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	2	
1ACMIN	ACHNANTHES MINUTISSIMA	3	
1NILIN	NITZSCHIA LINEARIS	2	
1NIPAC	NITZXCHIA PALEACEA	3	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	2	
1ACLIN	ACHNANTHES LINEARIS	5	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	9	
1SYAMP	SYNEDRA AMPHICEPHALA	4	
1NISPP	NITZSCHIA SP.	5	
1SUOVA	SURIRELLA OVATA	2	
1MERCC	MERIDION CIRCULARE VAR. CONSTRICTUM	P	
1SUOVL	SURIRELLA OVALIS	4	
1AMPER	AMPHORA PERPUSILLA	4	
1GOOLI	GOMPHONEMA OLIVACEUM	1	
1NIHUN	NITZSCHIA HUNGARICA	1	
1SYULA	SYNEDRA ULNA VAR. DANICA	P	
1CAAMP	CALONEIS AMPHISBAENA	P	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	P	
1NITRL	NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS	P	
1GYSPE	GYROSIGMA SPENCERII	P	
1SYULN	SYNEDRA ULNA	P	
1DIVUL	DIATOMA VULGARE	P	
2CHLSP	CHLAMYDOMONAS SP.		2
2COESP	COELASTRUM SP.		1
4PHSPP	PHORMIDIUM SP.		2
5EUSPP	EUGLENA SP.		P
4OSSPP	OSCILLATORIA SP.		1

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 06-30-82

C - I73   V - 100 ML   DF - 1:49   L - 50 MM   W - .561 MM   D - 1 MM   S - 3   A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - I58-PAI4   ANALYST - FHB

NUMBER COUNTED

TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	114	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	11	
1FRACB	FRAGILAREA CONSTRUENS VAR. BINODIS	P	
1RHCUR	RHOICOSPHENIA CURVATA	14	
1NARHY	NAVICULA RHYNCHOCEPHALA	1	
1ACMIN	ACHNANTHES MINUTISSIMA	3	
1NISPP	NITZSCHIA SP.	6	
1NILIN	NITZSCHIA LINEARIS	4	
1NICAP	NITZSCHIA CAPITELLATA	1	
1CYCME	CYCLOTELLA MENEGHINIANA	7	
1NIFRU	NITZSCHIA FRUSTULUM	17	
1NISIE	NITZSCHIA SIGMOIDEA	1	
1NASEA	NAVICULA SECRETA VAR. APICULATA	11	
1SUOVA	SURIRELLA OVATA	3	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	P	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	1	
1NIPAC	NITZXCHIA PALEACEA	6	
1NIDIS	NITZSCHIA DISSIPATA	3	
1GOPAR	GOMPHONEMA PARVULUM	1	
1FRACV	FRAGILARIA CONSTRUENS VAR. VENTER	3	
1SUOVL	SURIRELLA OVALIS	1	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	1	
1FRAVA	FRAGILARIA VAUCHERIAE	6	
1FRALE	FRAGILARIA LEPTOSTAURON	P	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	1	
1DITEE	DIATOMA TENUE VAR. ELONGATUM	1	
1NIPAL	NITZSCHIA PALEA	2	
1CYMLV	CYMBELLA LAEVIS	1	
1SYULA	SYNEDRA ULNA VAR. DANICA	P	
1NIHUN	NITZSCHIA HUNGARICA	2	
1DESPP	DENTICULA SP.	2	
1PIMIC	PINNULARIA MICROSTAURON	P	
1COCPE	COCCONEIS PEDICULUS	P	
1CYMAF	CYMBELLA AFFINIS	P	
1DITEN	DIATOMA TENUE	P	
1RHGIN	RHOPALODIA GIBBA VAR. VENTRICOSA	P	
5PHASE	PHACUS SP.		1
2CHLSP	CHLAMYDOMONAS SP.		1
2GRCOC	UNIDENTIFIED GREEN COCCOID		1

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 06-30-82

C - 243 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 3 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 159-PA15 ANALYST - FHB

NUMBER COUNTED

TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	128	
1ACMIN	ACHNANTHES MINUTISSIMA	4	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	5	
1CYCMF	CYCLOTELLA MENEGHINIANA	3	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	8	
1NILIN	NITZSCHIA LINEARIS	1	
1SUOVA	SURIRELLA OVATA	8	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	3	
1NIHUN	NITZSCHIA HUNGARICA	3	
1NISIE	NITZSCHIA SIGMOIDEA	P	
1FRAVA	FRAGILARIA VAUCHERIAE	4	
1CASPP	CALONEIS SP.	P	
1NIPAL	NITZSCHIA PALEA	4	
1NIFRU	NITZSCHIA FRUSTULUM	16	
1NAMUU	NAVICULA MUTICA VAR. UNDULATA	2	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	2	
1NIDIS	NITZSCHIA DISSIPATA	10	
1NICAP	NITZSCHIA CAPITELLATA	4	
1FRALE	FRAGILARIA LEPTOSTAURON	2	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	1	
1SUOVL	SURIRELLA OVALIS	2	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	2	
1NIPAC	NITZXCHIA PALEACEA	2	
1SYULN	SYNEDRA ULNA	1	
1RHCUR	RHOICOSPHENIA CURVATA	4	
1NASEA	NAVICULA SECRETA VAR. APICULATA	6	
1AMPER	AMPHORA PERPUSILLA	2	
1NIAPI	NITZSCHIA APICULATA	4	
1NIGRA	NITZSCHIA GRACILIS	1	
1NAPUC	NAVICULA PUPULA VAR. CAPITATA	1	
1NACRY	NAVICULA CRYPTOCEPHALA	1	
1NIFON	NITZSCHIA FONTICOLA	7	
1RHMUS	RHOPALODIA MUSCULUS	P	
1GOOLI	GOMPHONEMA OLIVACEUM	P	
1SYACU	SYNEDRA ACUS	P	
1GYSPE	GYROSIGMA SPENCERII	P	
4OSTIN	OSCILLATORIA TENUIS		1
2CHLSP	CHLAMYDOMONAS SP.		2
2STITE	STIGEOCLONIUM TENUE		P

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE - I
SAMPLE DATE - 06-30-82

C - 601 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA16 ANALYST - FHB

NUMBER COUNTED

TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	63	
1NIFRU	NITZSCHIA FRUSTULUM	91	
1NIAPI	NITZSCHIA APICULATA	6	
1ACMIN	ACHNANTHES MINUTISSIMA	10	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	5	
1ACLIN	ACHNANTHES LINEARIS	P	
1SUOVA	SURIRELLA OVATA	2	
1NIHUN	NITZSCHIA HUNGARICA	3	
1CYCME	CYCLOTELLA MENEGHINIANA	3	
1SUOVL	SURIRELLA OVALIS	6	
1RHCUR	RHOICOSPHENIA CURVATA	10	
1NIPAL	NITZSCHIA PALEA	16	
1NIFON	NITZSCHIA FONTICOLA	5	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	3	
1NAMUT	NAVICULA MUTICA	P	
1FRAVA	FRAGILARIA VAUCHERIAE	P	
1NISPP	NITZSCHIA SP.	P	
1RHMUS	RHOPALODIA MUSCULUS	P	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	P	
1NASEA	NAVICULA SECRETA VAR. APICULATA	19	
1COCPE	COCCONEIS PEDICULUS	1	
1THSPP	THALASSIOSIRA FLUVIATILIS	5	
1NIDIS	NITZSCHIA DISSIPATA	8	
1NALUZ	NAVICULA LUZONENSIS	1	
1NAARV	NAVICULA ARVENSIS	3	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	2	
1GOSPP	GOMPHONEMA SP.	1	
1NAHFU	NAVICULA HEUFLERI	P	
1NIPAC	NITZXCHIA PALEACEA	2	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	2	
1GOPAR	GOMPHONEMA PARVULUM	2	
1FRALE	FRAGILARIA LEPTOSTAURON	P	
1CYMAF	CYMBELLA AFFINIS	P	
1AMPER	AMPHORA PERPUSILLA	P	
1NAPUP	NAVICULA PUPULA	P	
1NISIE	NITZSCHIA SIGMOIDEA	P	
1NITRL	NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS	P	
1NILIN	NITZSCHIA LINEARIS	P	
1SYULN	SYNEDRA ULNA	P	
1CYDSO	CYMATOPLEURA SOLEA	P	
1HANAM	HANTZSCHIA AMPHIOXYS	P	
1RHGIN	RHOPALODIA GIBBA VAR. VENTRICOSA	P	
1DIVUL	DIATOMA VULGARE	P	
1CAAMP	CALONEIS AMPHISBAENA	P	
1PIVIM	PINNULARIA VIRIDIS VAR. MINOR	P	
4OSTEN	OSCILLATORIA TENVIS		P
4OSSPP	OSCILLATORIA SP.		P

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 06-30-82

C - 57I V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA17 ANALYST - EHB

TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1NIPAL	NITZSCHIA PALEA	2	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	62	
1CYCME	CYCLOTELLA MENEGHINIANA	7	
1NIDIS	NITZSCHIA DISSIPATA	8	
1NIFRU	NITZSCHIA FRUSTULUM	103	
1NIFON	NITZSCHIA FONTICOLA	13	
1SYPUC	SYNEDRA PULCHELLA	P	
1PISPP	PINNULARIA SP.	P	
1SUOVL	SURIRELLA OVALIS	11	
1NIAPI	NITZSCHIA APICULATA	15	
1ACMIN	ACHNANTHES MINUTISSIMA	18	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	6	
1SUOVA	SURIRELLA OVATA	10	
1RHCUR	RHOICOSPHENIA CURVATA	3	
1THSPP	THALASSIOSIRA FLUVIATILIS	2	
1HANAM	HANTZSCHIA AMPHIOXYS	P	
1NASEA	NAVICULA SECRETA VAR. APICULATA	10	
1SYDEL	SYNEDRA DELICATISSIMA	1	
1NILIN	NITZSCHIA LINEARIS	5	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	4	
1NAHEU	NAVICULA HEUFLERI	2	
1NIHUN	NITZSCHIA HUNGARICA	11	
1AMPER	AMPHORA PERPUSILLA	2	
1NAPRO	NAVICULA PROTRACTA	P	
1GOANG	GOMPHONEMA ANGUSTATUM	2	
1GOPAR	GOMPHONEMA PARVULUM	2	
1ACLAN	ACHNANTHES LANCEOLATA	2	
1NITPL	NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS	P	
1FRALF	FRAGILARIA LEPTOSTAURON	P	
1DIVUL	DIATOMA VULGARE	P	
1CYMAF	CYMBELLA AFFINIS	P	
1NISIE	NITZSCHIA SIGMOIDEA	P	
1RHMUS	RHOPALODIA MUSCULUS	P	
1NACUS	NAVICULA CUSPIDATA	P	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	P	
1GYSPE	GYROSIGMA SPENCERII	P	
1SYULN	SYNEDRA ULNA	P	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	P	
4OSTEN	OSCILLATORIA TENUIS		1
2STITE	STIGEOCLONIUM TENUE		P

SAMPLE STATION: WP03 - HUNTER CRK
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 06-30-82

C - 467 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA18 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1NIFRU	NITZSCHIA FRUSTULUM	70	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	96	
1NALUZ	NAVICULA LUZONENSIS	2	
1NIDIS	NITZSCHIA DISSIPATA	P	
1RHCUR	RHOICOSPHENIA CURVATA	2	
1SUOVL	SURIRELLA OVALIS	10	
1NILIN	NITZSCHIA LINEARIS	5	
1NIAPI	NITZSCHIA APICULATA	14	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	2	
1PISPP	PINNULARIA SP.	2	
1NASEA	NAVICULA SECRETA VAR. APICULATA	6	
1ACMIN	ACHNANTHES MINUTISSIMA	20	
1DIVUL	DIATOMA VULGARE	P	
1SUOVA	SURIRELLA OVATA	6	
1NITRL	NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS	2	
1NISIE	NITZSCHIA SIGMOIDEA	1	
1NIFON	NITZSCHIA FONTICOLA	7	
1NIHUN	NITZSCHIA HUNGARICA	4	
1RHGIN	RHOPALODIA GIBBA VAR. VENTRICOSA	2	
1NAMIN	NAVICULA MINIMA	2	
1ACLAN	ACHNANTHES LANCEOLATA	2	
1FRAVA	FRAGILARIA VAUCHERIAE	1	
1NAARV	NAVICULA ARVENSIS	3	
1GOSUB	GOMPHONEMA SUBCLAVATUM	2	
1CYCME	CYCLOTELLA MENEGHINIANA	1	
1ACLIN	ACHNANTHES LINEARIS	2	
1AMOVL	AMPHORA OVALIS VAR. PEDICULUS	P	
1THSPP	THALASSIOSIRA FLUVIATILIS	P	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	P	
1GYSPE	GYROSIGMA SPENCERII	P	
1CYDSO	CYMATOPLEURA SOLEA	P	
1SYULN	SYNEDRA ULNA	P	
1COCPE	COCCONEIS PEDICULUS	P	
4OSTEN	OSCILLATORIA TENVIS		1

PERIPHYTON BENCH SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WPL1 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 07-29-82

C - 222 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 15[illegible]-PA19 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
4PHSPP	PHORMIDIUM SP.		3
2OESPP	OEDOGONIUM SP.		2
2STITE	STIGEOCLONIUM TENUE		26
2TEMIN	TETRAEDRON MINIMUM		1
1RHCUR	RHOICOSPHENIA CURVATA	55	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	27	
1SYULN	SYNEDRA ULNA	6	
1DIVUL	DIATOMA VULGARE	7	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	30	
1SUOVA	SURIRELLA OVATA	P	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	20	
1HANAM	HANTZSCHIA AMPHIOXYS	P	
1ACMIN	ACHNANTHES MINUTISSIMA	12	
1COCPL	COCCONEIS PLACENTULA	P	
1NIFON	NITZSCHIA FONTICOLA	12	
1CYCME	CYCLOTELLA MENEGHINIANA	4	
1NIDIS	NITZSCHIA DISSIPATA	10	
1CYMSI	CYMBELLA SINUATA	P	
1NAMIN	NAVICULA MINIMA	2	
1GOOLI	GOMPHONEMA OLIVACEUM	7	
1GOPAR	GOMPHONEMA PARVULUM	2	
1SYDEL	SYNEDRA DELICATISSIMA	13	
1NIFRU	NITZSCHIA FRUSTULUM	7	
1AMPER	AMPHORA PERPUSILLA	2	
1FRAVA	FRAGILARIA VAUCHERIAE	8	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	1	
1COCPU	COCCONEIS PLACENTULA VAR. EUGLYPTA	P	
1NILIN	NITZSCHIA LINEARIS	P	
1SYAMP	SYNEDRA AMPHICEPHALA	P	
1NIPAL	NITZSCHIA PALEA	10	
1NIHUN	NITZSCHIA HUNGARICA	P	
1FRACV	FRAGILARIA CONSTRUENS VAR. VENTER	1	
1NASEA	NAVICULA SECRETA VAR. APICULATA	P	
1NACRY	NAVICULA CRYPTOCEPHALA	2	
1COCPE	COCCONEIS PEDICULUS	1	
1NICOM	NITZSCHIA COMMUNIS	1	
1NIPAC	NITZSCHIA PALEACEA	2	
1SYACU	SYNEDRA ACUS	2	

1NASPP	NAVICULA SP.	1
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	4
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	1
1NICAP	NITZSCHIA CAPITELLATA	1
1NITRL	NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS	P
1NIAPI	NITZSCHIA APICULATA	2
1STSPP	STEPHANODISCUS SP.	2

SAMPLE STATION WP01 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 07-29-82

C - 286   V - 100 ML   DF - 1148   L - 50 MM   W - .561 MM   D - 1 MM   S - 2   A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 15E-PA20   ANALYST - FHE

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1NIHUN	NITZSCHIA HUNGARICA	P	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	56	
1DIVUL	DIATOMA VULGARE	c	
1RHCUR	RHOICOSPHENIA CURVATA	60	
1ACMIN	ACHNANTHES MINUTISSIMA	13	
1SYULN	SYNEDRA ULNA	16	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	10	
1NIDIS	NITZSCHIA DISSIPATA	19	
1NIPAL	NITZSCHIA PALEA	16	
1COCPE	COCCONEIS PEDICULUS	P	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	9	
1AMPER	AMPHORA PERPUSILLA	P	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	17	
1HANAM	HANTZSCHIA AMPHIOXYS	1	
1GOOLI	GOMPHONEMA OLIVACEUM	10	
1RHMUS	RHOPALODIA MUSCULUS	1	
1ACLIN	ACHNANTHES LINEARIS	2	
1CYCME	CYCLOTELLA MENEGHINIANA	5	
1SYDEL	SYNEDRA DELICATISSIMA	20	
1NASEA	NAVICULA SECRETA VAR. APICULATA	10	
1GOPAR	GOMPHONEMA PARVULUM	2	
1NIAPI	NITZSCHIA APICULATA	7	
1FRAVA	FRAGILARIA VAUCHERIAE	5	
1NISPP	NITZSCHIA SP.	8	
1SYAMP	SYNEDRA AMPHICEPHALA	4	
1NIFRU	NITZSCHIA FRUSTULUM	1	
1THSPP	THALASSIOSIRA FLUVIATILIS	4	
1NIFON	NITZSCHIA FONTICOLA	2	
1NIPAC	NITZXCHIA PALEACEA	2	
1NISIE	NITZSCHIA SIGMOIDEA	P	
1NICAP	NITZSCHIA CAPITELLATA	2	

1CAAMP	CALONEIS AMPHISBAENA	P	
1GOSUB	GOMPHONEMA SUBCLAVATUM	P	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	P	
1CYDSO	CYMATOPLEURA SOLEA	P	
1SUOVA	SURIRELLA OVATA	P	
1AMPER	AMPHORA PERPUSILLA	P	
1CYMAF	CYMBELLA AFFINIS	P	
2STITE	STIGEOCLONIUM TENUE		27
2MOUSP	MOUGEOTIA SP.		2
5PHASE	PHACUS SP.		1
4LYNSP	LYNGBYA SP.		2

SAMPLE STATION NPO1 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 07-29-82

C - 252 V - 100 ML DF - 1148 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 156-PA2I ANALYST - FHB

		NUMBER COUNTED	
TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1SYULN	SYNEDRA ULNA	12	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	13	
1RHCUR	RHOICOSPHENIA CURVATA	53	
1GOPAR	GOMPHONEMA PARVULUM	P	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	29	
1SYDEL	SYNEDRA DELICATISSIMA	9	
1GOOLI	GOMPHONEMA OLIVACEUM	5	
1NASEA	NAVICULA SECRETA VAR. APICULATA	5	
1CYCME	CYCLOTELLA MENEGHINIANA	2	
1DIVUL	DIATOMA VULGARE	3	
1NACRY	NAVICULA CRYPTOCEPHALA	P	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	17	
1ACMIN	ACHNANTHES MINUTISSIMA	10	
1CYMSI	CYMBELLA SINUATA	2	
1NIFRU	NITZSCHIA FRUSTULUM	5	
1NIPAC	NITZSCHIA PALEACEA	2	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	4	
1NIPAL	NITZSCHIA PALEA	3	
1NIAPI	NITZSCHIA APICULATA	1	
1NANOT	NAVICULA NOTHA	2	
1NIDIS	NITZSCHIA DISSIPATA	5	
1NAMIN	NAVICULA MINIMA	2	
1NIFON	NITZSCHIA FONTICOLA	13	
1SUOVA	SURIRELLA OVATA	1	
1FRVAU	FRAGILARIA VAUCHERIAE	6	
1NICAP	NITZSCHIA CAPITELLATA	3	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	2	

1NISPP	NITZSCHIA SP.	3	
1AMPER	AMPHORA PERPUSILLA	5	
1FRACB	FRAGILAREA CONSTRUENS VAR. BINODIS	3	
1NIHUN	NITZSCHIA HUNGARICA	1	
1SYACU	SYNEDRA ACUS	3	
1NISIG	NITZSCHIA SIGMOIDEA	2	
1THSPP	THALASSIOSIRA FLUVIATILIS	1	
1ACLIN	ACHNANTHES LINEARIS	2	
1COCPE	COCCONEIS PEDICULUS	P	
1GOSUB	GOMPHONEMA SUBCLAVATUM	P	
1CAVEM	CALONEIS VENTRICOSA VAR. MINUTA	P	
2STITE	STIGEOCLONIUM TENUE		17
2MOUSP	MOUGEOTIA SP.		7
4OSTEN	OSCILLATORIA TENUIS		1
2CHLSP	CHLAMYDOMONAS SP.		3
4ANASP	ANABAENA SP.		1
4OSSPP	OSCILLATORIA SP.		2

SAMPLE STATION: WPO2 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 07-29-82

C - 132 V - 100 ML DF - 1:49 L - 50 MM W - .56 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA22 ANALYST - FHH

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1RHCUR	RHOICOSPHENIA CURVATA	48	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	61	
1NANOT	NAVICULA NOTHA	2	
1FRAVA	FRAGILARIA VAUCHERIAE	7	
1SYDEL	SYNEDRA DELICATISSIMA	15	
1NAMIN	NAVICULA MINIMA	4	
1NICAP	NITZSCHIA CAPITELLATA	2	
1NISPP	NITZSCHIA SP.	5	
1NIPAL	NITZSCHIA PALEA	5	
1NICOM	NITZSCHIA COMMUNIS	2	
1SYULN	SYNEDRA ULNA	7	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	15	
1ACMIN	ACHNANTHES MINUTISSIMA	4	
1AMPER	AMPHORA PERPUSILLA	4	
1NIDIS	NITZSCHIA DISSIPATA	22	
1CYMEN	CYCLOTELLA MENEGHINIANA	6	
1GOOLI	GOMPHONEMA OLIVACEUM	5	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	12	
1SUOVA	SURIRELLA OVATA	1	
1NIFON	NITZSCHIA FONTICOLA	14	
1COPLI	COCCONEIS PLACENTULA VAR. LINEATA	17	

1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	1	
1DIVUL	DIATOMA VULGARE	7	
1NISIG	NITZSCHIA SIGMOIDEA	P	
1NASEA	NAVICULA SECRETA VAR. APICULATA	4	
1HAMAM	HANTZSCHIA AMPHIOXYS	2	
1GOPAR	GOMPHONEMA PARVULUM	3	
1NIFRU	NITZSCHIA FRUSTULUM	1	
1ACLAN	ACHNANTHES LANCEOLATA	1	
1RHMUS	RHOPALODIA MUSCULUS	2	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	2	
1ACLIN	ACHNANTHES LINEARIS	2	
1NIPAL	NITZSCHIA PALEACEA	1	
1NACRY	NAVICULA CRYPTOCEPHALA	P	
1NITRL	NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS	P	
5TRSPP	TRACHELOMONAS SP.		1
2STITE	STIGEOCLONIUM TENUE		29
2CHLSP	CHLAMYDOMONAS SP.		2
2MOLSP	MOUGEOTIA SP.		2
2ANKSP	ANKISTRODESMUS SP.		2
4OSSPP	OSCILLATORIA SP.		1

SAMPLE STATION: WPC2 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 07-29-82

C - 118 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 15M-PA23 ANALYST - MMB

TAXON CODE	TAXON	NUMBER COUNTED DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED NON-DIATOMS SEDGWICK-RAFTER COUNT
1GOPAR	GOMPHONEMA PARVULUM	22	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	19	
1ACLAL	ACHNANTHES LANCEOLATA VAR. DUBIA	40	
1RHCUR	RHOICOSPHENIA CURVATA	50	
1SYULN	SYNEDRA ULNA	7	
1NACUS	NAVICULA CUSPIDATA	P	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	25	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	7	
1ACMIN	ACHNANTHES MINUTISSIMA	23	
1CYCME	CYCLOTELLA MENEGHINIANA	5	
1NICOM	NITZSCHIA COMMUNIS	2	
1NIPAL	NITZSCHIA PALEA	6	
1THSPP	THALASSIOSIRA FLUVIATILIS	1	
1SYDEL	SYNEDRA DELICATISSIMA	6	
1NIFON	NITZSCHIA FONTICOLA	19	
1SUOVA	SURIRELLA OVATA	2	
1GOOLI	GOMPHONEMA OLIVACEUM	15	
1FRAVA	FRAGILARIA VAUCHERIAE	16	

1	BACILLARIOPHYTA	2	
1NIPAL	NITZSCHIA PALEACEA	2	
1AMVEN	AMPHORA VENETA	P	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	4	
1NIFRU	NITZSCHIA FRUSTULUM	10	
1CASPP	CALONEIS SP.	2	
1CYMSI	CYMBELLA SINUATA	2	
1NIDIS	NITZSCHIA DISSIPATA	5	
1NAMIN	NAVICULA MINIMA	1	
1NAVIR	NAVICULA VIRIDULA	P	
1NACRY	NAVICULA CRYPTOCEPHALA	P	
2CHLSP	CHLAMYDOMONAS SP.		2
5TRSPP	TRACHELOMONAS SP.		P
2STITE	STIGEOCLONIUM TENUE		29
2MOUSP	MOUGEOTIA SP.		2
4PHSPP	PHORMIDIUM SP.		1

SAMPLE STATION: KP02 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 07-29-82

C - 38 V - 100 ML DF - 1:4F L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOC NUMBER - 15E-PA24 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED NON-DIATOMS SEDGWICK-RAFTER COUNT
1GOOLI	GOMPHONEMA OLIVACEUM	8	
1SYULN	SYNEDRA ULNA	3	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	5	
1GOPAR	GOMPHONEMA PARVULUM	21	
1COCPL	COCCONEIS PLACENTULA VAR. LINEATA	21	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	17	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	26	
1FRAVA	FRAGILARIA VAUCHERIAE	4	
1AMPER	AMPHORA PERPUSILLA	3	
1RHCUR	RHOICOSPHENIA CURVATA	57	
1NIDIS	NITZSCHIA DISSIPATA	9	
1NASEA	NAVICULA SECRETA VAR. APICULATA	6	
1ACMIN	ACHNANTHES MINUTISSIMA	13	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	7	
1NIPAL	NITZSCHIA PALEACEA	4	
1NIFRU	NITZSCHIA FRUSTULUM	9	
1NIFON	NITZSCHIA FONTICOLA	7	
1SYDEL	SYNEDRA DELICATISSIMA	P	
1GOSUB	GOMPHONEMA SUBCLAVATUM	3	
1NILIN	NITZSCHIA LINEARIS	1	
1SUOVA	SURIRELLA OVATA	1	
1NIPAL	NITZSCHIA PALEA	6	

1NANOT	NAVICULA NOTHA	1	
1SYFAT	SYNEDRA FASCICULATA VAR. TRUNCATA	1	
1FRACB	FRAGILARIA CONSTRUENS VAR. BINODIS	6	
1NAMIN	NAVICULA MINIMA	2	
1CYCME	CYCLOTELLA MENEGHINIANA	3	
1ACLIN	ACHNANTHES LINEARIS	2	
1NIAPI	NITZSCHIA APICULATA	1	
1NISIE	NITZSCHIA SIGMOIDEA	P	
1DIVUL	DIATOMA VULGARE	P	
2STITE	STIGEOCLONIUM TENUE		17
5TRSPP	TRACHELOMONAS SP.		2
2ANKSP	ANKISTRODESMUS SP.		1
4ANASP	ANABAENA SP.		P
2CHLSP	CHLAMYDOMONAS SP.		F

PERIPHYTON BENCH SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 07-02-82

C - 418 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 159-PA25 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
ICYCME	CYCLOTELLA MENEGHINIANA	P	
INIDIS	NITZSCHIA DISSIPATA	82	
IRHCUR	RHOICOSPHENIA CURVATA	35	
INAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
IGOOLI	GOMPHONEMA OLIVACEUM	8	
INACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	38	
ICYMMS	CYMBELLA MINUTA VAR. SILESIACA	4	
ICOCPL	COCCONEIS PLACENTULA VAR. LINEATA	4	
IAMPER	AMPHORA PERPUSILLA	7	
ISYPUC	SYNEDRA PULCHELLA	P	
IGOPAR	GOMPHONEMA PARVULUM	8	
INIAPI	NITZSCHIA APICULATA	3	
INIHUN	NITZSCHIA HUNGARICA	3	
INIFON	NITZSCHIA FONTICOLA	22	
IACMIN	ACHNANTHES MINUTISSIMA	23	
INAHEU	NAVICULA HEUFLERI	22	
INASEA	NAVICULA SECRETA VAR. APICULATA	25	
ISYFAT	SYNEDRA FASCICULATA VAR. TRUNCATA	P	
INAPEL	NAVICULA PELLICULOSA	2	
INASAI	NAVICULA SALINARUM VAR. INTERMEDIA	2	
INIFRU	NITZSCHIA FRUSTULUM	29	
INIPAL	NITZSCHIA PALEA	3	
IFRAVA	FRAGILARIA VAUCHERIAE	4	
INISPP	NITZSCHIA SP.	5	
ICYMAF	CYMBELLA AFFINIS	2	
ISUOVA	SURIRELLA OVATA	1	
INAARV	NAVICULA ARVENSIS	4	
IACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	3	
IUNPEN	UNIDENTIFIED PENNATE DIATOMS	4	
IACLIN	ACHNANTHES LINEARIS	3	
INAMUT	NAVICULA MUTICA	2	
IGOSPP	GOMPHONEMA SP.	2	
INACRY	NAVICULA CRYPTOCEPHALA	1	
ISYMIN	SYNEDRA MINUSCULA	2	
INISIG	NITZSCHIA SIGMOIDEA	P	
ISYULN	SYNEDRA ULNA	P	
2STTEN	STIGEOCLONIUM TENUE		8
4LYNSP	LYNGBYA SP.		11

SAMPLE STATION: SPOL - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 09-02-82

C - 697 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA26 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1NIFRU	NITZSCHIA FRUSTULUM	71	
1RHCUR	RHOICOSPHENIA CURVATA	31	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
1NAHEU	NAVICULA HEUFLERI	25	
1NACRY	NAVICULA CRYPTOCEPHALA	16	
1NIDIS	NITZSCHIA DISSIPATA	77	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	56	
1NISPP	NITZSCHIA SP.	2	
1ACMIN	ACHNANTHES MINUTISSIMA	32	
1NIPAL	NITZSCHIA PALEA	12	
1NASEA	NAVICULA SECRETA VAR. APICULATA	18	
1GOOLI	GOMPHONEMA OLIVACEUM	13	
1SYFAS	SYNEDRA FASCICULATA	P	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	9	
1NIFON	NITZSCHIA FONTICOLA	16	
1GOPAR	GOMPHONEMA PARVULUM	5	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	3	
1NIAPI	NITZSCHIA APICULATA	3	
1FRAVA	FRAGILARIA VAUCHERIAE	3	
1NAARV	NAVICULA ARVENSIS	2	
1CYCME	CYCLOTELLA MENEGHINIANA	3	
1CYMMU	CYMBELLA MUELLERI	P	
1CYMAF	CYMBELLA AFFINIS	4	
1NIAMP	NITZXCHIA AMPHIBIA	1	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	5	
1ACLIN	ACHNANTHES LINEARIS	4	
1NAMIN	NAVICULA MINIMA	3	
1NIIGN	NITZSCHIA IGNORATA	1	
1GOSPP	GOMPHONEMA SP.	1	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	2	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	1	
1SUOVA	SURIRELLA OVATA	1	
1AMPER	AMPHORA PERPUSILLA	3	
1SYULN	SYNEDRA ULNA	P	
1CYMAS	CYMBELLA ASPERA	P	
1HANAM	HANTZSCHIA AMPHIOXYS	P	
1SUOVL	SURIRELLA OVALIS	P	

2STIIE	STIG OCLONIUM TENUE		33
4LYNEP	LYNGBYA SP.		11
2UNFIL	UNIDENTIFIED FILAMENT		1
2MOUSP	MOUGEOTIA SP.		P

SAMPLE STATION: WP01 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - ?
SAMPLE DATE - 09-02-82

C - 44: V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 153-PA27 ANALYST - FHB

		NUMBER COUNTED	
TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1NIFRU	NITZSCHIA FRUSTULUM	41	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	18	
1AMPER	AMPHORA PERPUSILLA	13	
1GOOLI	GOMPHONEMA OLIVACEUM	9	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	1	
1NIDIS	NITZSCHIA DISSIPATA	39	
1NIFON	NITZSCHIA FONTICOLA	3	
1NASEA	NAVICULA SECRETA VAR. APICULATA	6	
1NAHEU	NAVICULA HEUFLERI	7	
1COCPU	COCCONEIS PLACENTULA VAR. EUGLYPTA	P	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	6	
1RHCUR	RHOICOSPHENIA CURVATA	17	
1SUOVA	SURIRELLA OVATA	P	
1ACMIN	ACHNANTHES MINUTISSIMA	17	
1NAARV	NAVICULA ARVENSIS	6	
1NIPAL	NITZSCHIA PALEA	1	
1ACLIN	ACHNANTHES LINEARIS	5	
1FRAVA	FRAGILARIA VAUCHERIAE	8	
1NIPAL	NITZSCHIA PALEA	1	
1NAMIN	NAVICULA MINIMA	5	
1GOTEN	GOMPHONEMA TENELLUM	1	
1NISPP	NITZSCHIA SP.	P	
1NIAPI	NITZSCHIA APICULATA	1	
1CYMSI	CYMBELLA SINUATA	2	
1CYCMI	CYCLOTELLA MENEGHINIANA	1	
1COCPE	COCCONEIS PEDICULUS	1	
1NIDEN	NITZSCHIA DENTICULA	1	
1SYACU	SYNEDRA ACUS	1	
1SYULN	SYNEDRA ULNA	1	
1SYPUC	SYNEDRA PULCHELLA	P	
1SUOVL	SURIRELLA OVALIS	P	
1DIVUL	DIATOMA VULGARE	P	
1CYAFF	CYMBELLA AFFINIS	P	

1HAHAM	HANTZSCHIA AMPHIOXYS	P	
1CYMIS	CYMBELLA MINUTA VAR. SILESIACA	P	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	P	
2STITE	STIGEOCLONIUM TENUE		37
4ANASP	ANABAENA SP.		P
4LYNSP	LYNGBYA SP.		13
4PHOSP	PHORMIDIUM SP.		1

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 09-02-92

C - 221 V - 100 ML OF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA28 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1NAHEU	NAVICULA HEUFLERI	23	
1NIFRU	NITZSCHIA FRUSTULUM	32	
1ACMIN	ACHNANTHES MINUTISSIMA	14	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
1COCPL	COCCONEIS PLACENTULA VAR. LINEATA	11	
1DITEE	DIATOMA TENUE VAR. ELONGATUM	P	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	7	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	30	
1GOOLI	GOMPHONEMA OLIVACEUM	7	
1NIPAL	NITZSCHIA PALEA	5	
1AMPER	AMPHORA PERPUSILLA	15	
1RHCUR	RHOICOSPHENIA CURVATA	26	
1SYMIN	SYNEDRA MINUSCULA	12	
1NAARV	NAVICULA ARVENSIS	2	
1HAHAM	HANTZSCHIA AMPHIOXYS	P	
1ACLIN	ACHNANTHES LINEARIS	2	
1NASPP	NAVICULA SP.	2	
1NASAI	NAVICULA SALINARUM VAR. INTERMEDIA	6	
1SUOVA	SURIRELLA OVATA	2	
1DIVUL	DIATOMA VULGARE	P	
1NIDIS	NITZSCHIA DISSIPATA	12	
1SYDLI	SYNEDRA DELICATISSIMA	1	
1NASEA	NAVICULA SECRETA VAR. APICULATA	8	
1NIFON	NITZSCHIA FONTICOLA	5	
1SUOVL	SURIRELLA OVALIS	P	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	P	
1FRAVA	FRAGILARIA VAUCHERIAE	10	
1GOSPP	GOMPHONEMA SP.	1	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	1	
1NIAPI	NITZSCHIA APICULATA	2	
1SYFAS	SYNEDRA FASCICULATA	1	

1THSPP	THALASSIOSIRA FLUVIATILIS	1	
1CYMSI	CYMBELLA SINUATA	1	
1AMOVP	AMPHORA OVALIS	2	
1CYCME	CYCLOTELLA MENEGHINIANA	1	
1SYSPP	SYNEDRA SP.	1	
1NAPUP	NAVICULA PUPULA	P	
1NITRL	NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS	1	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	P	
1SYPUC	SYNEDRA PULCHELLA	P	
1GYSPE	GYROSIGMA SPENCERII	P	
4MESPP	MERISMOPEDEA SP.		P
4ANASP	ANABAENA SP.		P
2STITE	STIGEOCLONIUM TENUE		1
2CLOSP	CLOSTERIUM SP.		P
4LYNSP	LYNGBYA SP.		1
4OSTEN	OSCILLATORIA TENUIS		1

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 07-02-82

C - 408 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 153-PA29 ANALYST - FHB

		NUMBER COUNTED	
TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1SYDEL	SYNEDRA DELICATISSIMA	P	
1ACMIN	ACHNANTHES MINUTISSIMA	25	
1NAARV	NAVICULA ARVENSIS	4	
1NAHEU	NAVICULA HEUFLERI	27	
1SYULN	SYNEDRA ULNA	P	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
1NIFRU	NITZSCHIA FRUSTULUM	28	
1NIDIS	NITZSCHIA DISSIPATA	25	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	38	
1NASEA	NAVICULA SECRETA VAR. APICULATA	12	
1DITEE	DIATOMA TENUE VAR. ELONGATUM	2	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	2	
1RHCUR	RHOICOSPHENIA CURVATA	29	
1GOPAR	GOMPHONEMA PARVULUM	5	
1NASAI	NAVICULA SALINARUM VAR. INTERMEDIA	2	
1CYMCY	CYMBELLA CYMBIFORMIS	2	
1FRAVA	FRAGILARIA VAUCHERIAE	3	
1AMPER	AMPHORA PERPUSILLA	13	
1SYMIN	SYNEDRA MINUSCULA	2	
1SYRUF	SYNEDRA RUMPENS VAR. FAMILIARIS	P	
1SYPUC	SYNEDRA PULCHELLA	P	
1COCPU	COCCONEIS PLACENTULA VAR. EUGLYPTA	2	

1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	14	
1NIPAL	NITZSCHIA PALEA	3	
1NACRY	NAVICULA CRYPTOCEPHALA	P	
1SUOVA	SURIRELLA OVATA	5	
1COCPE	COCCONEIS PEDICULUS	P	
1CYMSI	CYMBELLA SINUATA	5	
1AMOVF	AMPHORA OVALIS VAR. AFFINIS	2	
1NIPAL	NITZSCHIA PALEA	1	
1NAMIN	NAVICULA MINIMA	7	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	2	
1NIAPI	NITZSCHIA APICULATA	4	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	3	
1CYCME	CYCLOTELLA MENEGHINIANA	2	
1DIVUL	DIATOMA VULGARE	P	
1ACLIN	ACHNANTHES LINEARIS	2	
1NASPP	NAVICULA SP.	1	
1SYFAS	SYNEDRA FASCICULATA	1	
1NIFON	NITZSCHIA FONTICOLA	1	
1NISPP	NITZSCHIA SP.	2	
1GOOLI	GOMPHONEMA OLIVACEUM	3	
1CYMAF	CYMBELLA AFFINIS	1	
1NAMUU	NAVICULA MUTICA VAR. UNDULATA	2	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	1	
1FRALE	FRAGILARIA LEPTOSTAURON	1	
1PIBRE	PINNULARIA BREBISSONII	P	
1NACUS	NAVICULA CUSPIDATA	P	
1COCPE	COCCONEIS PEDICULUS	P	
1HAAM	HANTZSCHIA AMPHIOXYS	P	
2STITE	STIGEOCLONIUM TENUE		4
4LYNSP	LYNGBYA SP.		P

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 09-02-82

C - 433 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 159-PA30 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	101	
1NAARV	NAVICULA ARVENSIS	2	
1SUOVA	SURIRELLA OVATA	2	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	15	
1ACMIN	ACHNANTHES MINUTISSIMA	11	
1SYDEL	SYNEDRA DELICATISSIMA	1	
1AMPER	AMPHORA PERPUSILLA	4	
1NIDIS	NITZSCHIA DISSIPATA	16	

1NIFRU	NITZSCHIA FRUSTULUM	25	
1NAHEU	NAVICULA HEUFLERI	23	
1NASAI	NAVICULA SALINARUM VAR. INTERMEDIA	3	
1RHCUR	RHOICOSPHENIA CURVATA	31	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	12	
1NIFON	NITZSCHIA FONTICOLA	2	
1CYCME	CYCLOTELLA MENEGHINIANA	2	
1FRAVA	FRAGILARIA VAUCHERIAE	2	
1NIPAL	NITZSCHIA PALEA	3	
1CYMSI	CYMBELLA SINUATA	1	
1GOPAR	GOMPHONEMA PARVULUM	3	
1NASEA	NAVICULA SECRETA VAR. APICULATA	4	
1GOOLI	GOMPHONEMA OLIVACEUM	1	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	2	
1NANOT	NAVICULA NOTHA	2	
1SYFAS	SYNEDRA FASCICULATA	P	
1SYULN	SYNEDRA ULNA	P	
1CYMAF	CYMBELLA AFFINIS	4	
1DIVUL	DIATOMA VULGARE	P	
1DITEE	DIATOMA TENUE VAR. ELONGATUM	3	
1NIAPI	NITZSCHIA APICULATA	1	
1HANAM	HANTZSCHIA AMPHIOXYS	P	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	P	
1NIAMP	NITZXCHIA AMPHIBIA	P	
1NARHY	NAVICULA RHYNCHOCEPHALA	P	
1AMOVF	AMPHORA OVALIS VAR. AFFINIS	P	
1NAMUT	NAVICULA MUTICA	P	
1SYPUC	SYNEDRA PULCHELLA	P	
1GOSUB	GOMPHONEMA SUBCLAVATUM	P	
2STITE	STIGEOCLONIUM TENUE		6
4LYNSP	LYNGBYA SP.		2

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 09-02-82

C - 106   V - 100 ML   DF - 1:49   L - 50 MM   W - .561 MM   D - 1 MM   S - 6   A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA31   ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	110	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	P	
1NAARV	NAVICULA ARVENSIS	P	
1DIVUL	DIATOMA VULGARE	1	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	2	
1NIFRU	NITZSCHIA FRUSTULUM	P	
1GOOLI	GOMPHONEMA OLIVACEUM	2	

		Diatoms Proportional Count	Non-Diatoms Sedgwick-Rafter Count
1NAHEU	NAVICULA HEUFLERI	1	
1NIFON	NITZSCHIA FONTICOLA	4	
1RHCUR	RHOICOSPHENIA CURVATA	1	
1GOPAR	GOMPHONEMA PARVULUM	1	
1NASEA	NAVICULA SECRETA VAR. APICULATA	P	
2OESP	OEDOGONIUM SP.		10
4CHRSP	CHROOCOCCUS SP.		2
4LYNSP	LYNGBYA SP.		1

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 07-02-82

C - 11(V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 6 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 15?-PA32 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	101	
1NIFRU	NITZSCHIA FRUSTULUM	8	
1NAHEU	NAVICULA HEUFLERI	4	
1RHCUR	RHOICOSPHENIA CURVATA	4	
1GOOLI	GOMPHONEMA OLIVACEUM	7	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	P	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	2	
1COCPE	COCCONEIS PEDICULUS	P	
1COCPU	COCCONEIS PLACENTULA VAR. EUGLYPTA	1	
1GOPAR	GOMPHONEMA PARVULUM	2	
1GOSUB	GOMPHONEMA SUBCLAVATUM	1	
1CYMAF	CYMBELLA AFFINIS	2	
1NIAPI	NITZSCHIA APICULATA	4	
1NIFON	NITZSCHIA FONTICOLA	2	
1GOINT	GOMPHONEMA INTRICATUM	1	
1FRAVA	FRAGILARIA VAUCHERIAE	P	
1NITRL	NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS	P	
4ANASP	ANABAENA SP.		2
2CHLSP	CHLAMYDOMONAS SP.		1
2STTIE	STIGEOCLONIUM TENUE		P

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE -

SAMPLE DATE - 07-02-82

C - 154 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 6 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA33 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
INASEA	NAVICULA SECRETA VAR. APICULATA	2	
INIDIS	NITZSCHIA DISSIPATA	3	
ICOCPI	COCCONEIS PLACENTULA VAR. LINEATA	100	
IGOOLI	GOMPHONEMA OLIVACEUM	9	
INAVIA	NAVICULA VIRIDULA VAR. AVENACEA	3	
INIFON	NITZSCHIA FONTICOLA	2	
INIFRU	NITZSCHIA FRUSTULUM	3	
IACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	P	
IGOTEN	GOMPHONEMA TENELLUM	2	
IDITEE	DIATOMA TENUE VAR. ELONGATUM	P	
INAHEU	NAVICULA HEUFLERI	2	
ISUOVA	SURIRELLA OVATA	P	
2STITE	STIGEOCLONIUM TENUE		4
2OESPP	OEDOGONIUM SP.		2

PERIPHYTON BENCH SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WPO1 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 10-04-82

C - 326 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA34 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
1NIFRU	NITZSCHIA FRUSTULUM	15	
1NIDIS	NITZSCHIA DISSIPATA	50	
1AMPER	AMPHORA PERPUSILLA	9	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	9	
1ACMIN	ACHNANTHES MINUTISSIMA	57	
1FRAVA	FRAGILARIA VAUCHERIAE	1	
1RHCUR	RHOICOSPHENIA CURVATA	6	
1CYMAF	CYMBELLA AFFINIS	1	
1NAHEU	NAVICULA HEUFLERI	15	
1GOPAR	GOMPHONEMA PARVULUM	7	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	4	
1NANUT	NAVICULA NOTHA	5	
1CYCME	CYCLOTELLA MENEGHINIANA	1	
1NAMIN	NAVICULA MINIMA	5	
1NASEA	NAVICULA SECRETA VAR. APICULATA	9	
1GOOLI	GOMPHONEMA OLIVACEUM	1	
1SUOVA	SURIRELLA OVATA	1	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	1	
1CYMSI	CYMBELLA SINUATA	P	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	P	
1NAMUT	NAVICULA MUTICA	P	
4OSTEN	OSCILLATORIA TENVIS		2

SAMPLE STATION: WPO1 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 10-04-82

C - 384 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA35 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1ACMIN	ACHNANTHES MINUTISSIMA	76	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	101	
1NIDIS	NITZSCHIA DISSIPATA	51	
1NAHEU	NAVICULA HEUFLERI	10	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	22	
1SUOVA	SURIRELLA OVATA	1	
1NIFRU	NITZSCHIA FRUSTULUM	20	
1RHCUR	RHOICOSPHENIA CURVATA	10	
1NAMIN	NAVICULA MINIMA	1	
1AMPER	AMPHORA PERPUSILLA	4	
1GOOLI	GOMPHONEMA OLIVACEUM	3	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	5	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	1	
1NASEA	NAVICULA SECRETA VAR. APICULATA	11	
1NANOT	NAVICULA NOTHA	10	
1NAARV	NAVICULA ARVENSIS	4	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	2	
1GOPAR	GOMPHONEMA PARVULUM	3	
1NASAI	NAVICULA SALINARUM VAR. INTERMEDIA	P	
1CYMSI	CYMBELLA SINUATA	1	
1DIVUL	DIATOMA VULGARE	P	
1SYULN	SYNEDRA ULNA	P	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	P	
1CYMAF	CYMBELLA AFFINIS	P	
2STITE	STIGEOCLONIUM TENUE		P

SAMPLE STATION: WPO1 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 10-04-82

C - 387 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA36 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1AMPER	AMPHORA PERPUSILLA	5	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	2	

1ACMIN	ACHNANTHES MINUTISSIMA	101	
1NIDIS	NITZSCHIA DISSIPATA	83	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	62	
1FRAVA	FRAGILARIA VAUCHERIAE	7	
1NASEA	NAVICULA SECRETA VAR. APICULATA	11	
1NIFRU	NITZSCHIA FRUSTULUM	17	
1NAHEU	NAVICULA HEUFLERI	11	
1GOOLI	GOMPHONEMA OLIVACEUM	3	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	10	
1GOPAR	GOMPHONEMA PARVULUM	12	
1GOSPP	GOMPHONEMA SP.	1	
1GOGRA	GOMPHONEMA GRACILE	P	
1GOTEN	GOMPHONEMA TENELLUM	2	
1RHCUR	RHOICOSPHENIA CURVATA	5	
1NAARV	NAVICULA ARVENSIS	1	
1NANOT	NAVICULA NOTHA	11	
1NAMIN	NAVICULA MINIMA	1	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	2	
1NIPAL	NITZSCHIA PALEA	1	
1SYDEL	SYNEDRA DELICATISSIMA	P	
1NILIN	NITZSCHIA LINEARIS	1	
1SUOVA	SURIRELLA OVATA	1	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	1	
1DIVUL	DIATOMA VULGARE	P	
1CYMAF	CYMBELLA AFFINIS	P	
1NASAI	NAVICULA SALINARUM VAR. INTERMEDIA	P	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	P	

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 10-04-82

C - 116 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA37 ANALYST - FHB

		NUMBER COUNTED	
		DIATOMS	NON-DIATOMS
TAXON CODE	TAXON	PROPORTIONAL COUNT	SEDGWICK-RAFTER COUNT
1NIDIS	NITZSCHIA DISSIPATA	46	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
1ACMIN	ACHNANTHES MINUTISSIMA	44	
1COCPE	COCCONEIS PEDICULUS	2	
1NIFRU	NITZSCHIA FRUSTULUM	22	
1GOPAR	GOMPHONEMA PARVULUM	11	
1RHCUR	RHOICOSPHENIA CURVATA	12	
1AMPER	AMPHORA PERPUSILLA	14	
1NASAI	NAVICULA SALINARUM VAR. INTERMEDIA	6	
1NASEA	NAVICULA SECRETA VAR. APICULATA	12	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	21	

1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	6	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	11	
1NAHEU	NAVICULA HEUFLERI	12	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	2	
1GOTEN	GOMPHONEMA TENELLUM	2	
1GOOLI	GOMPHONEMA OLIVACEUM	5	
1FRAVA	FRAGILARIA VAUCHERIAE	2	
1NAMIN	NAVICULA MINIMA	5	
1NANOT	NAVICULA NOTHA	5	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	2	
1ACLIN	ACHNANTHES LINEARIS	2	
1CYCME	CYCLOTELLA MENEGHINIANA	3	
1NAMUT	NAVICULA MUTICA	1	
1CYMSI	CYMBELLA SINUATA	2	
1NIAMP	NITZSCHIA AMPHIBIA	1	
1CYMAF	CYMBELLA AFFINIS	1	
1NAARV	NAVICULA ARVENSIS	3	
1FRACB	FRAGILAREA CONSTRUENS VAR. BINODIS	5	
1NIFON	NITZSCHIA FONTICOLA	1	
1SUOVA	SURIRELLA OVATA	P	
1NISIE	NITZSCHIA SIGMOIDEA	P	
1SUANG	SURIRELLA ANGUSTATA	P	
4OSSPP	OSCILLATORIA SP.		P

SAMPLE STATION: WPO2 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 10-04-82

C - 201 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA38 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
1SUOVA	SURIRELLA OVATA	P	
1CYMSI	CYMBELLA SINUATA	1	
1AMPER	AMPHORA PERPUSILLA	7	
1FRAVA	FRAGILARIA VAUCHERIAE	5	
1RHCUR	RHOICOSPHENIA CURVATA	5	
1NIFRU	NITZSCHIA FRUSTULUM	15	
1HANAM	HANTZSCHIA AMPHIOXYS	1	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	3	
1ACMIN	ACHNANTHES MINUTISSIMA	22	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	8	
1NIDIS	NITZSCHIA DISSIPATA	14	
1FRALE	FRAGILARIA LEPTOSTAURON	2	
1GOPAR	GOMPHONEMA PARVULUM	2	
1NASEA	NAVICULA SECRETA VAR. APICULATA	10	

INAHEU	NAVICULA HEUFLERI	6	
IGJOLI	GOMPHONEMA OLIVACEUM	2	
ISYSPP	SYNEDRA SP.	1	
IACLAN	ACHNANTHES LANCEOLATA	1	
ICOCPI	COCCONEIS PLACENTULA VAR. LINEATA	6	
INAMUU	NAVICULA MUTICA VAR. UNDULATA	1	
INAPUP	NAVICULA PUPULA	2	
IFRACV	FRAGILARIA CONSTRUENS VAR. VENTER	1	
INIPAL	NITZSCHIA PALEA	2	
ICYMMS	CYMBELLA MINUTA VAR. SILESIACA	1	
ICYMAF	CYMBELLA AFFINIS	P	
INIAPI	NITZSCHIA APICULATA	P	
INATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	P	
IGYSPI	GYROSIGMA SPENCERII	P	
IPIBRE	PINNULARIA BREBISSONII	P	
INILIN	NITZSCHIA LINEARIS	P	
ISTASM	STAURONEIS SMITHII	P	
ICOCPE	COCCONEIS PEDICULUS	P	
IDIVUL	DIATOMA VULGARE	P	
INISIE	NITZSCHIA SIGMOIDEA	P	
ISYULN	SYNEDRA ULNA	P	
4LYNSP	LYNGBYA SP.		1

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 10-04-82

C - 181 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA39 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
INIAPI	NITZSCHIA APICULATA	P	
INAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
INIDIS	NITZSCHIA DISSIPATA	22	
INIFRU	NITZSCHIA FRUSTULUM	22	
IUNPEN	UNIDENTIFIED PENNATE DIATOMS	2	
ICOCPI	COCCONEIS PLACENTULA VAR. LINEATA	8	
INACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	14	
IACMIN	ACHNANTHES MINUTISSIMA	13	
IAMPER	AMPHORA PERPUSILLA	6	
IGOPAR	GOMPHONEMA PARVULUM	5	
INISPP	NITZSCHIA SP.	1	
IRHCUR	RHOICOSPHENIA CURVATA	6	
INASLA	NAVICULA SECRETA VAR. APICULATA	12	
ICYCME	CYCLOTELLA MENEGHINIANA	2	
INATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	4	
INIPAL	NITZSCHIA PALEA	1	

1SUOVA	SURIRELLA OVATA	2	
1FRAVA	FRAGILARIA VAUCHERIAE	2	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	5	
1NAHEU	NAVICULA HEUFLERI	4	
1NASAI	NAVICULA SALINARUM VAR. INTERMEDIA	5	
1FRURH	FRUSTULIA RHOMBOIDES	2	
1NANOT	NAVICULA NOTHA	6	
1AMOVP	AMPHORA OVALIS	P	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	2	
1SYFAS	SYNEDRA FASCICULATA	P	
1GOOLI	GOMPHONEMA OLIVACEUM	P	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	P	
1NILIN	NITZSCHIA LINEARIS	P	
1DIVUL	DIATOMA VULGARE	P	
1COCPE	COCCONEIS PEDICULUS	P	
1CYMCY	CYMBELLA CYMBIFORMIS	P	
1NIACI	NITZSCHIA ACICULARIS	P	
1GYSPE	GYROSIGMA SPENCERII	P	
1HANAM	HANTZSCHIA AMPHIOXYS	P	
5EUSPP	EUGLENA SP.		1

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 10-04-82

C - 156 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 4 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA40 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1AMPER	AMPHORA PERPUSILLA	12	
1ACMIN	ACHNANTHES MINUTISSIMA	100	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	27	
1NIDIS	NITZSCHIA DISSIPATA	63	
1NIFRU	NITZSCHIA FRUSTULUM	72	
1NAHEU	NAVICULA HEUFLERI	21	
1GOPAR	GOMPHONEMA PARVULUM	22	
1COCPL	COCCONEIS PLACENTULA VAR. LINEATA	28	
1FRALE	FRAGILARIA LEPTOSTAURON	1	
1FRAVA	FRAGILARIA VAUCHERIAE	2	
1NASEA	NAVICULA SECRETA VAR. APICULATA	19	
1RHCUR	RHOICOSPHENIA CURVATA	25	
1GOOLI	GOMPHONEMA OLIVACEUM	10	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	9	
1DEELE	DENTICULA ELEGANS	2	
1THSPP	THALASSIOSIRA FLUVIATILIS	2	
1NANOT	NAVICULA NOTHA	9	
1NAMIN	NAVICULA MINIMA	2	

1HANAM	HANTZSCHIA AMPHIOXYS	P	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	14	
1NAARV	NAVICULA ARVENSIS	3	
1GOTEN	GOMPHONEMA TENELLUM	6	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	2	
1SUOVA	SURIRELLA OVATA	1	
1SYACU	SYNEDRA ACUS	1	
1RHMUS	RHOPALODIA MUSCULUS	2	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	P	
1DIVUL	DIATOMA VULGARE	P	
2STITE	STIGEOCLONIUM TENUE		3

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 10-04-82

C - 57 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 6 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA41 ANALYST - FHB

		NUMBER COUNTED	
TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1ACMIN	ACHNANTHES MINUTISSIMA	45	
1NANOT	NAVICULA NOTHA	8	
1RHCUR	RHOICOSPHENIA CURVATA	85	
1NIDIS	NITZSCHIA DISSIPATA	20	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	52	
1NAMIN	NAVICULA MINIMA	2	
1NASAI	NAVICULA SALINARUM VAR. INTERMEDIA	3	
1NAHEU	NAVICULA HEUFLERI	20	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
1NISPP	NITZSCHIA SP.	4	
1NIFRU	NITZSCHIA FRUSTULUM	37	
1NASEA	NAVICULA SECRETA VAR. APICULATA	10	
1GOOLI	GOMPHONEMA OLIVACEUM	27	
1FRALE	FRAGILARIA LEPTOSTAURON	4	
1GOPAR	GOMPHONEMA PARVULUM	4	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	5	
1NIAPI	NITZSCHIA APICULATA	7	
1NAMUU	NAVICULA MUTICA VAR. UNDULATA	P	
1AMPER	AMPHORA PERPUSILLA	8	
1GOSPP	GOMPHONEMA SP.	3	
1CYCME	CYCLOTELLA MENEGHINIANA	3	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	2	
1CYMAF	CYMBELLA AFFINIS	2	
1SUOVA	SURIRELLA OVATA	2	
1AMOVF	AMPHORA OVALIS VAR. AFFINIS	1	
1GOTEN	GOMPHONEMA TENELLUM	1	
1RHMUS	RHOPALODIA MUSCULUS	3	

1NAPUC	NAVICULA PUPULA VAR. CAPITATA	1	
1SYPUC	SYNEDRA PULCHELLA	P	
1SUOVA	SURIRELLA OVATA	2	
1NAMUT	NAVICULA MUTICA	2	
1STANL	STAURONEIS ANICEPS	1	
1FRACB	FRAGILAREA CONSTRUENS VAR. BINODIS	7	
1PIBRE	PINNULARIA BREBISSONII	3	
1SYULN	SYNEDRA ULNA	1	
1CYMAF	CYMBELLA AFFINIS	1	
1FRURH	FRUSTULIA RHOMBOIDES	2	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	5	
1ENORN	ENTOMONEIS ORNATA	1	
1STSPP	STEPHANODISCUS SP.	1	
1NIHUN	NITZSCHIA HUNGARICA	1	
2STITE	STIGEOCLONIUM TENUE		3

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 10-04-82

C - 57 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 6 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA42 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1NIDIS	NITZSCHIA DISSIPATA	26	
1RHCUR	RHOICOSPHENIA CURVATA	100	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	7	
1AMPER	AMPHORA PERPUSILLA	10	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	65	
1NIDIS	NITZSCHIA DISSIPATA	38	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	41	
1NIFRU	NITZSCHIA FRUSTULUM	49	
1NAMUU	NAVICULA MUTICA VAR. UNDULATA	1	
1NAHEU	NAVICULA HEUFLERI	19	
1ACMIN	ACHNANTHES MINUTISSIMA	80	
1GOPAR	GOMPHONEMA PARVULUM	29	
1DEELE	DENTICULA ELEGANS	5	
1GOOLI	GOMPHONEMA OLIVACEUM	20	
1NASEA	NAVICULA SECRETA VAR. APICULATA	17	
1NAARV	NAVICULA ARVENSIS	5	
1RHMUS	RHOPALODIA MUSCULUS	2	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	8	
1NAPUP	NAVICULA PUPULA	3	
1STSPP	STEPHANODISCUS SP.	2	
1GOTEN	GOMPHONEMA TENELLUM	6	
1FRAVA	FRAGILARIA VAUCHERIAE	4	
1NANOT	NAVICULA NOTHA	3	

1NIAPI	NITZSCHIA APICULATA	1	
1CYMAF	CYMBELLA AFFINIS	3	
1SUOVA	SURIRELLA OVATA	1	
2STITE	STIGEOCLONIUM TENUE		1

PERIPHYTON BENCH SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 11-03-82

C - 158 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA43 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	101	
1GOOLI	GOMPHONEMA OLIVACEUM	15	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	23	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	1	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	1	
1NANOT	NAVICULA NOTHA	5	
1NIDIS	NITZSCHIA DISSIPATA	32	
1NIFRU	NITZSCHIA FRUSTULUM	6	
1NASAI	NAVICULA SALINARUM VAR. INTERMEDIA	3	
1RHCUR	RHOICOSPHENIA CURVATA	3	
1SUOVA	SURIRELLA OVATA	1	
1CYCME	CYCLOTELLA MENEGHINIANA	2	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	1	
1ACMIN	ACHNANTHES MINUTISSIMA	12	
1NAHEU	NAVICULA HEUFLERI	2	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	2	
1AMPER	AMPHORA PERPUSILLA	2	
1NASEA	NAVICULA SECRETA VAR. APICULATA	5	
1NIAPI	NITZSCHIA APICULATA	1	
1DITEE	DIATOMA TENUE VAR. ELONGATUM	1	
1NICAP	NITZSCHIA CAPITELLATA	P	
1NAMUU	NAVICULA MUTICA VAR. UNDULATA	1	
1NISIE	NITZSCHIA SIGMOIDEA	P	
1NATRI	NAVICULA TRIPUNCTATA	1	
1GOPAR	GOMPHONEMA PARVULUM	1	
1DIVUL	DIATOMA VULGARE	P	
1SYDEL	SYNEDRA DELICATISSIMA	P	
1CYMAF	CYMBELLA AFFINIS	P	
1NILIN	NITZSCHIA LINEARIS	P	
4ANASP	ANABAENA SP.		P
4LYNSP	LYNGBYA SP.		1

SAMPLE STATION: WP01 - STEWART

NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 11-03-82

C - 162 V - 100 ML DI - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA44 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1GOOLI	GOMPHONEMA OLIVACEUM	46	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
1RHCUR	RHOICUSPHENIA CURVATA	2	
1NIPAL	NITZSCHIA PALEA	1	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	P	
1NIDIS	NITZSCHIA DISSIPATA	52	
1NASAI	NAVICULA SALINARUM VAR. INTERMEDIA	8	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	34	
1ACMIN	ACHNANTHES MINUTISSIMA	23	
1NASEA	NAVICULA SECRETA VAR. APICULATA	11	
1NIFRU	NITZSCHIA FRUSTULUM	13	
1NANOT	NAVICULA NOTHA	8	
1NAHEU	NAVICULA HEUFLERI	4	
1COCPE	COCCONEIS PEDICULUS	1	
1NATRI	NAVICULA TRIPUNCTATA	2	
1DIVUL	DIATOMA VULGARE	1	
1NAMIN	NAVICULA MINIMA	1	
1HANAM	HANTZSCHIA AMPHIOXYS	1	
1ACLAN	ACHNANTHES LANCEOLATA	P	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	2	
1NIAPI	NITZSCHIA APICULATA	1	
1GOPAR	GOMPHONEMA PARVULUM	1	
1SUOVA	SURIRELLA OVATA	1	
1CYMSI	CYMBELLA SINUATA	1	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	P	
1AMOVF	AMPHORA OVALIS VAR. AFFINIS	P	
1CYMAF	CYMBELLA AFFINIS	P	
1NAMUT	NAVICULA MUTICA	P	
4LYNSP	LYNGBYA SP.		P

SAMPLE STATION: WP01 - STEWART
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 11-03-82

C - 164 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA45 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS - PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
1NIDIS	NITZSCHIA DISSIPATA	57	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
1GOOLI	GOMPHONEMA OLIVACEUM	41	
1NASEA	NAVICULA SECRETA VAR. APICULATA	13	
1GOPAR	GOMPHONEMA PARVULUM	3	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	40	
1NATRI	NAVICULA TRIPUNCTATA	2	
1NIFRU	NITZSCHIA FRUSTULUM	26	
1NANOI	NAVICULA NOTHA	18	
1ACLIN	ACHNANTHES LINEARIS	3	
1NIPAL	NITZSCHIA PALEA	4	
1AMPER	AMPHORA PERPUSILLA	4	
1RHCUR	RHOICOSPHENIA CURVATA	3	
1ACMIN	ACHNANTHES MINUTISSIMA	38	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	2	
1GOTEN	GOMPHONEMA TENELLUM	3	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	3	
1NICOM	NITZSCHIA COMMUNIS	1	
1SUOVA	SURIRELLA OVATA	5	
1FRAVA	FRAGILARIA VAUCHERIAE	1	
1GOSUB	GOMPHONEMA SUBCLAVATUM	2	
1CYCME	CYCLOTELLA MENEGHINIANA	1	
1NICAP	NITZSCHIA CAPITELLATA	2	
1AMVEN	AMPHORA VENETA	1	
1NAMUI	NAVICULA MUTICA	1	
1NARHY	NAVICULA RHYNCHOCEPHALA	2	
1NASAI	NAVICULA SALINARUM VAR. INTERMEDIA	1	
1NIPAC	NITZSCHIA PALEACEA	1	
1DIVUL	DIATOMA VULGARE	1	
1FRACB	FRAGILAREA CONSTRUENS VAR. BINODIS	5	
1SYACU	SYNEDRA ACUS	P	
4LYNSP	LYNGBYA SP.		P

SAMPLE STATION: WPO2 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 11-03-82

C - 232 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - I58-PA46 ANALYST - FHB

NUMBER COUNTED

TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	101	
1GOOLI	GOMPHONEMA OLIVACEUM	22	
1NASEA	NAVICULA SECRETA VAR. APICULATA	10	
1NIFRU	NITZSCHIA FRUSTULUM	18	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	10	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	7	
1NIDIS	NITZSCHIA DISSIPATA	28	
1UNPLN	UNIDENTIFIED PENNATE DIATOMS	3	
1SUOVA	SURIRELLA OVATA	2	
1ACMIN	ACHNANTHES MINUTISSIMA	21	
1NAHEU	NAVICULA HEUFLERI	3	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	3	
1NANOT	NAVICULA NOTHA	5	
1CYMAF	CYMBELLA AFFINIS	1	
1NAARV	NAVICULA ARVENSIS	1	
1NASAI	NAVICULA SALINARUM VAR. INTERMEDIA	2	
1CYMAF	CYMBELLA AFFINIS	2	
1GOPAR	GOMPHONEMA PARVULUM	5	
1CYMSI	CYMBELLA SINUATA	2	
1RHCUR	RHOICOSPHENIA CURVATA	3	
1SYDEL	SYNEDRA DELICATISSIMA	1	
1NITRL	NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS	1	
1NATRI	NAVICULA TRIPUNCTATA	1	
1AMPER	AMPHORA PERPUSILLA	3	
1FRAVA	FRAGILARIA VAUCHERIAE	1	
1FRACO	FRAGILARIA CONSTRUENS	1	
1NAMIN	NAVICULA MINIMA	2	
1CYCME	CYCLOTELLA MENEGHINIANA	1	
1GOTEN	GOMPHONEMA TENELLUM	1	
1SYULN	SYNEDRA ULNA	1	
1NIAPI	NITZSCHIA APICULATA	P	
1THSPP	THALASSIOSIRA FLUVIATILIS	P	
1NIIGN	NITZSCHIA IGNORATA	P	

SAMPLE STATION: WPO2 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 11-03-82

C - 200 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 2 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA47 ANALYST - FHB

NUMBER COUNTED

TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1CYCME	CYCLOTELLA MENEGHINIANA	3	

1GOOLI	GOMPHONEMA OLIVACEUM	7	
1NAVIA	NAVICULA VIRIDULA VAR. AVENACEA	105	
1NIDIS	NITZSCHIA DISSIPATA	70	
1UNPEN	UNIDENTIFIED PENNATE DIATOMS	3	
1NASAI	NAVICULA SALINARUM VAR. INTERMEDIA	2	
1NISPP	NITZSCHIA SP.	1	
1GOPAR	GOMPHONEMA PARVULUM	4	
1ACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	5	
1CYMSI	CYMBELLA SINUATA	1	
1ACMIN	ACHNANTHES MINUTISSIMA	19	
1COCPI	COCCONEIS PLACENTULA VAR. LINEATA	4	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	17	
1NANOT	NAVICULA NOTHA	20	
1NIFRU	NITZSCHIA FRUSTULUM	25	
1NASEA	NAVICULA SECRETA VAR. APICULATA	15	
1FRALE	FRAGILARIA LEPTOSTAURON	2	
1AMPLR	AMPHORA PERPUSILLA	7	
1SUOVA	SURIRELLA OVATA	5	
1NAHEU	NAVICULA HEUFLERI	2	
1COCPE	COCCONEIS PEDICULUS	1	
1NIPAL	NITZSCHIA PALEA	2	
1NICAP	NITZSCHIA CAPITELLATA	2	
1HANAM	HANTZSCHIA AMPHIOXYS	2	
1GOSUB	GOMPHONEMA SUBCLAVATUM	1	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	1	
1NATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	2	
1RHCUR	RHOICOSPHENIA CURVATA	3	
1NIGRA	NITZSCHIA GRACILIS	1	
1SYDEL	SYNEDRA DELICATISSIMA	P	
1NILIN	NITZSCHIA LINEARIS	P	
1NIAPI	NITZSCHIA APICULATA	P	
1NITRL	NITZSCHIA TRYBLIONELLA VAR. LEVIDENSIS	P	
4LYNSP	LYNGBYA SP.		P

SAMPLE STATION: WP02 - MIDDLE
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 11-03-82

C - 176   V - 100 ML   DF - 1:49   L - 50 MM   W - .561 MM   D - 1 MM   S - 2   A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA48   ANALYST - FHB

		NUMBER COUNTED	
TAXON CODE	TAXON	DIATOMS PROPORTIONAL COUNT	NON-DIATOMS SEDGWICK-RAFTER COUNT
1GOPAR	GOMPHONEMA PARVULUM	4	
1NANOT	NAVICULA NOTHA	8	
1CYCME	CYCLOTELLA MENEGHINIANA	1	
1NACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	8	
1NASEA	NAVICULA SECRETA VAR. APICULATA	9	

IACLAD	ACHNANTHES LANCEOLATA VAR. OUBIA	6
ISUOVA	SURIRELLA OVATA	3
ICOCPI	COCCONEIS PLACENTULA VAR. LINEATA	5
INIAPI	NITZSCHIA APICULATA	1
IACMIN	ACHNANTHES MINUTISSIMA	13
IGOTEN	GOMPHONEMA TENELLUM	3
IRHCUR	RHOICOSPHENIA CURVATA	1
INAMIN	NAVICULA MINIMA	1
IGOOLI	GOMPHONEMA OLIVACEUM	16
INIDIS	NITZSCHIA OISSIPATA	17
INAVIA	NAVICULA VIRIOULA VAR. AVENACEA	101
ICOCPU	COCCONEIS PLACENTULA VAR. EUGLYPTA	2
ICYMAF	CYMBELLA AFFINIS	2
INIFRU	NITZSCHIA FRUSTULUM	8
ISYACU	SYNEDRA ACUS	1
INASAI	NAVICULA SALINARUM VAR. INTERMEOIA	1
INAHEU	NAVICULA HEUFLERI	2
INASAI	NAVICULA SALINARUM VAR. INTERMEOIA	1
ICYMMS	CYMBELLA MINUTA VAR. SILESIACA	P
IDIVUL	DIATOMA VULGARE	P

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE - 1
SAMPLE DATE - 11-03-82

C - 47 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 10 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 158-PA49 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
ISYULN	SYNEDRA ULNA	P	
ICYMAF	CYMBELLA AFFINIS	6	
INAHEU	NAVICULA HEUFLERI	5	
INASEA	NAVICULA SECRETA VAR. APICULATA	7	
IRHCUR	RHOICOSPHENIA CURVATA	18	
IACLAD	ACHNANTHES LANCEOLATA VAR. OUBIA	18	
IRHMUS	RHOPALODIA MUSCULUS	1	
INACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	13	
ICOCPI	COCCONEIS PLACENTULA VAR. LINEATA	10	
INASAI	NAVICULA SALINARUM VAR. INTERMEOIA	2	
ISYAMP	SYNEDRA AMPHICEPHALA	1	
INANOT	NAVICULA NOTHA	9	
INIFRU	NITZSCHIA FRUSTULUM	20	
IFRAVA	FRAGILARIA VAUCHERIAE	6	
INAVIA	NAVICULA VIRIOULA VAR. AVENACEA	100	
IGOOLI	GOMPHONEMA OLIVACEUM	17	
INIDIS	NITZSCHIA OISSIPATA	15	
IACMIN	ACHNANTHES MINUTISSIMA	22	

INIAPI	NITZSCHIA APICULATA	3	
ICYCME	CYCLOTELLA MENEGHINIANA	2	
IAMPER	AMPHORA PERPUSILLA	4	
ISTSPP	STEPHANODISCUS SP.	2	
INISIE	NITZSCHIA SIGMOIDEA	1	
INATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	1	
INAMIN	NAVICULA MINIMA	1	
ISYACU	SYNEDRA ACUS	1	
IGOTEN	GOMPHONEMA TENELLUM	2	
IMASPP	MASTOGLOIA SPP.	P	
IGOSUB	GOMPHONEMA SUBCLAVATUM	P	

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE - 2
SAMPLE DATE - 11-03-82

C - 25 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 10 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - 153-PA50 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
INIDIS	NITZSCHIA DISSIPATA	30	
IACMIN	ACHNANTHES MINUTISSIMA	29	
INAVIA	NAVICULA VIRIDULA VAR. AVENACEA	100	
INIFRU	NITZSCHIA FRUSTULUM	32	
INACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	14	
IGOOLI	GOMPHONEMA OLIVACEUM	49	
INASEA	NAVICULA SECRETA VAR. APICULATA	18	
IRHCUR	RHOICOSPHENIA CURVATA	13	
IGOTEN	GOMPHONEMA TENELLUM	5	
INIPAL	NITZSCHIA PALEA	1	
INANOT	NAVICULA NOTHA	15	
ICOCPI	COCCONEIS PLACENTULA VAR. LINEATA	38	
INAHEU	NAVICULA HEUFLERI	7	
IACLAD	ACHNANTHES LANCEOLATA VAR. DUBIA	5	
INIAPI	NITZSCHIA APICULATA	4	
IDIVUL	DIATOMA VULGARE	2	
ISUOVA	SURIRELLA OVATA	1	
IACLAN	ACHNANTHES LANCEOLATA	1	
IAMPER	AMPHORA PERPUSILLA	9	
IFRALE	FRAGILARIA LEPTOSTAURON	P	
IAMOVF	AMPHORA OVALIS VAR. AFFINIS	1	
INASPP	NAVICULA SP.	2	
INAMUT	NAVICULA MUTICA	5	
ISYULN	SYNEDRA ULNA	P	
IFRAVA	FRAGILARIA VAUCHERIAE	4	
INIHUN	NITZSCHIA HUNGARICA	2	
IGOPAR	GOMPHONEMA PARVULUM	3	

IUNPEN	UNIDENTIFIED PENNATE DIATOMS	1
ISUOVA	SURIRELLA OVATA	2
IPIBRE	PINNULARIA BREBISSONII	2
ICYCME	CYCLOTELLA MENEGHINIANA	3
ICYMAF	CYMBELLA AFFINIS	2

SAMPLE STATION: WP03 - HUNTER
NUMBER OF REPLICATES - 3

REPLICATE - 3
SAMPLE DATE - 11-03-82

C - 28 V - 100 ML DF - 1:49 L - 50 MM W - .561 MM D - 1 MM S - 10 A - 3750 MM2
SUBSTRATE - GLASS SLIDES

LOG NUMBER - I58-PA51 ANALYST - FHB

TAXON CODE	TAXON	NUMBER COUNTED: DIATOMS PROPORTIONAL COUNT	NUMBER COUNTED: NON-DIATOMS SEDGWICK-RAFTER COUNT
IRHCUR	RHOICOSPHENIA CURVATA	9	
IACMIN	ACHNANTHES MINUTISSIMA	37	
INAVIA	NAVICULA VIRIDULA VAR. AVENACEA	102	
ICOCPI	COCCONEIS PLACENTULA VAR. LINEATA	41	
IUNPEN	UNIDENTIFIED PENNATE DIATOMS	2	
INASEA	NAVICULA SECRETA VAR. APICULATA	9	
INACRV	NAVICULA CRYPTOCEPHALA VAR. VENETA	14	
INASAI	NAVICULA SALINARUM VAR. INTERMEDIA	6	
IGOOLI	GOMPHONEMA OLIVACEUM	26	
INIFRU	NITZSCHIA FRUSTULUM	30	
INALAD	NAVICULA LANCEOLATA VAR. DUBIA	2	
ICYCME	CYCLOTELLA MENEGHINIANA	9	
INIDIS	NITZSCHIA DISSIPATA	15	
INIHUN	NITZSCHIA HUNGARICA	3	
INANOT	NAVICULA NOTHA	12	
INATSC	NAVICULA TRIPUNCTATA VAR. SCHIZONEMOIDES	2	
INAHEU	NAVICULA HEUFLERI	3	
IGOTEN	GOMPHONEMA TENELLUM	7	
ICYMSI	CYMBELLA SINUATA	1	
INAMIN	NAVICULA MINIMA	2	
INISIE	NITZSCHIA SIGMOIDEA	P	
IGOPAR	GOMPHONEMA PARVULUM	5	
ISYACU	SYNEDRA ACUS	1	
IFRALE	FRAGILARIA LEPTOSTAURON	2	
ISUOVA	SURIRELLA OVATA	2	
IACMIN	ACHNANTHES MINUTISSIMA	2	
INAMUT	NAVICULA MUTICA	1	
IFRAVA	FRAGILARIA VAUCHERIAE	3	
ICYMCY	CYMBELLA CYMBIFORMIS	1	
INAPUP	NAVICULA PUPULA	1	
INIAPI	NITZSCHIA APICULATA	3	
ICYMAF	CYMBELLA AFFINIS	1	
INIAPI	NITZSCHIA APICULATA	1	

1DITIE	DIATOMA TENUE VAR. ELONGATUM	. P	
1AMPER	AMPHORA PERPUSILLA	1	
1CYMMS	CYMBELLA MINUTA VAR. SILESIACA	2	
4ANASP	ANABAENA SP.		1

TABLE 2.5.2-12

PERIPHYTON BIOMASS BENCH SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE DATE - 06-01-82
ANALYST - MARVIN
AREA SCRAPED - 37.5 CM2

STATION-REP	DRY WEIGHT (GM)	ASH WEIGHT (GM)
WP01-1	44.7375	44.7070
WP01-2	45.3290	45.2684
WP01-3	48.5975	48.5644
WP02-1	47.7996	47.7551
WP02-2	41.4530	41.3412
WP02-3	47.2782	47.2062
WP03-1	44.0621	44.0114
WP03-2	46.8168	46.7396
WP03-3	45.0631	45.0222

PERIPHYTON BIOMASS BENCH SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE DATE - 06-30-82
ANALYST - MARVIN
AREA SCRAPED - 37.5 CM2

STATION-REP	DRY WEIGHT (GM)	ASH WEIGHT (GM)
WP01-1	65.1134	65.0646
WP01-2	60.8715	60.8084
WP01-3	62.8146	62.7552
WP02-1	59.8824	59.8330
WP02-2	70.2777	70.2294
WP02-3	57.0896	57.0432
WP03-1	86.1488	86.0625
WP03-2	59.2370	59.1692
WP03-3	92.4188	92.3624

PERIPHYTON BIOMASS BENCH SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE DATE - 07-29-82
ANALYST - MARVIN
AREA SCRAPED - 37.5 CM2

STATION-REP	DRY WEIGHT (GM)	ASH WEIGHT (GM)
WP01-1	88.3879	88.3095
WP01-2	82.6081	82.5546
WP01-3	77.0779	77.0210
WP02-1	72.9892	72.9516
WP02-2	74.1851	74.1495
WP02-3	73.5242	73.4828

PERIPHYTON BIOMASS BENCH SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE DATE - 09-02-82
ANALYST - MARVIN
AREA SCRAPED - 37.5 CM2

STATION-REP	DRY WEIGHT (GM)	ASH WEIGHT (GM)
WP01-1	65.3332	65.2731
WP01-2	61.0041	60.9491
WP01-3	62.9368	62.8862
WP02-1	60.1257	60.0662
WP02-2	70.3320	70.2746
WP02-3	57.2417	57.1793
WP03-1	48.4808	48.4752
WP03-2	46.9326	46.9278
WP03-3	46.5448	46.5404

PERIPHYTON BIOMASS BENCH SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE DATE - 10-04-82
ANALYST - MARVIN
AREA SCRAPED - 37.5 CM2

STATION-REP	DRY WEIGHT (GM)	ASH WEIGHT (GM)
WP01-1	45.2059	45.1700
WP01-2	44.7313	44.7075
WP01-3	48.6370	48.6028
WP02-1	85.9905	85.9503
WP02-2	59.1120	59.0801
WP02-3	92.4222	92.3791
WP03-1	88.1045	88.0991
WP03-2	82.4414	82.4332
WP03-3	76.8745	76.8641

PERIPHYTON BIOMASS BENCH SHEET

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE DATE - 11-03-82
ANALYST - MARVIN
AREA SCRAPED - 37.5 CM2

STATION-REP	DRY WEIGHT (GM)	ASH WEIGHT (GM)
WP01-1	47.0691	47.0469
WP01-2	46.7002	46.6773
WP01-3	47.5790	47.5570
WP02-1	43.7497	43.7201
WP02-2	46.6977	46.6762
WP02-3	46.1394	46.1174
WP03-1	48.4743	48.4714
WP03-2	40.5211	40.5209
WP03-3	44.5665	44.5653

TABLE 2.5.2-13

PERIPHYTON BIOMASS ANALYSIS

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE DATE - 06-01-82
AREA SCRAPED - 37.5 CM2

STATION-REP	DRY WEIGHT (GM)	ASH WEIGHT (GM)	BIOMASS (MG/CM2)	STATION AVERAGE (MG/CM2)
WP01-1	44.7375	44.7070	.813	
WP01-2	45.3290	45.2684	1.616	
WP01-3	48.5975	48.5644	.883	1.104
WP02-1	47.7896	47.7551	.920	
WP02-2	41.4530	41.3412	2.981	
WP02-3	47.2782	47.2062	1.920	1.940
WP03-1	44.0621	44.0114	1.352	
WP03-2	46.8168	46.7396	2.059	
WP03-3	45.0631	45.0222	1.091	1.500

PERIPHYTON BIOMASS ANALYSIS

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE DATE - 06-30-82
AREA SCRAPED - 37.5 CM2

STATION-REP	DRY WEIGHT (GM)	ASH WEIGHT (GM)	BIOMASS (MG/CM2)	STATION AVERAGE (MG/CM2)
WP01-1	65.1134	65.0646	1.301	
WP01-2	60.8715	60.8084	1.683	
WP01-3	62.8146	62.7552	1.584	1.523
WP02-1	59.8824	59.8330	1.317	
WP02-2	70.2777	70.2294	1.288	
WP02-3	57.0896	57.0432	1.237	1.281
WP03-1	86.1488	86.0625	2.301	
WP03-2	59.2370	59.1692	1.808	
WP03-3	92.4188	92.3624	1.504	1.871

PERIPHYTON BIOMASS ANALYSIS

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE DATE - 07-29-82
AREA SCRAPED - 37.5 CM2

STATION-REP	DRY WEIGHT (GM)	ASH WEIGHT (GM)	BIOMASS (MG/CM2)	STATION AVERAGE (MG/CM2)
WP01-1	88.3879	88.3095	2.091	
WP01-2	82.6081	82.5546	1.427	
WP01-3	77.0779	77.0210	1.517	1.678
WP02-1	72.9892	72.9516	1.003	
WP02-2	74.1851	74.1495	.949	
WP02-3	73.5242	73.4828	1.104	1.019

PERIPHYTON BIOMASS ANALYSIS

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE DATE - 09-02-82
AREA SCRAPED - 37.5 CM2

STATION-REP	DRY WEIGHT (GM)	ASH WEIGHT (GM)	BIOMASS (MG/CM2)	STATION AVERAGE (MG/CM2)
WP01-1	65.3332	65.2731	1.603	
WP01-2	61.0041	60.9491	1.467	
WP01-3	62.9368	62.8862	1.349	1.473
WP02-1	60.1257	60.0662	1.587	
WP02-2	70.3320	70.2946	.997	
WP02-3	57.2417	57.1793	1.664	1.416
WP03-1	48.4808	48.4752	.149	
WP03-2	46.9326	46.9278	.128	
WP03-3	46.5448	46.5404	.117	.132

PERIPHYTON BIOMASS ANALYSIS

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE DATE - 10-04-82
AREA SCRAPED - 37.5 CM2

STATION-REP	DRY WEIGHT (GM)	ASH WEIGHT (GM)	BIOMASS (MG/CM2)	STATION AVERAGE (MG/CM2)
WP01-1	45.2059	45.1700	.957	
WP01-2	44.7313	44.7075	.635	
WP01-3	48.6370	48.6028	.912	.835
WP02-1	85.9905	85.9503	1.072	
WP02-2	59.1120	59.0801	.851	
WP02-3	92.4222	92.3791	1.149	1.024
WP03-1	88.1045	88.0991	.144	
WP03-2	82.4414	82.4332	.219	
WP03-3	76.8745	76.8641	.277	.213

PERIPHYTON BIOMASS ANALYSIS

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE DATE - 11-03-82
AREA SCRAPED - 37.5 CM2

STATION-REP	DRY WEIGHT (GM)	ASH WEIGHT (GM)	BIOMASS (MG/CM2)	STATION AVERAGE (MG/CM2)
WP01-1	47.0691	47.0469	.592	
WP01-2	46.7002	46.6773	.611	
WP01-3	47.5790	47.5570	.587	.596
WP02-1	43.7497	43.7201	.789	
WP02-2	46.6977	46.6762	.573	
WP02-3	46.1394	46.1174	.587	.650
WP03-1	48.4743	48.4714	.077	
WP03-2	40.5211	40.5209	.005	
WP03-3	44.5665	44.5653	.032	.038

TABLE 2.5.2-14

PERIPHYTON DENSITY AND SPECIES DIVERSITY ESTIMATES

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 06-01-82

TAXON	DENSITY (UNITS/MM2) REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA VAR. DUBIA	61.91	74.79	.00	45.57	39.98	1.36
ACHNANTHES LINEARIS	.00	.00	32.85	10.95	18.97	.33
ACHNANTHES MINUTISSIMA	309.54	392.64	492.78	398.32	91.75	11.90
AMPHORA PERPUSILLA	.00	.00	16.43	5.48	9.48	.16
COCCONEIS PLACENTULA VAR. EUGLYPTA	20.64	.00	16.43	12.35	10.90	.37
COCCONEIS PLACENTULA VAR. LINEATA	10.32	.00	16.43	8.91	8.30	.27
CYMBELLA MINUTA	.00	18.70	.00	6.23	10.79	.19
CYMBELLA MINUTA VAR. SILESIACA	.00	56.09	.00	18.70	32.38	.56
CYMBELLA SINUATA	20.64	37.39	65.70	41.24	22.78	1.23
DIATOMA VULGARE	.00	.00	16.43	5.48	9.48	.16
FRAGILARIA CROTONENSIS	20.64	.00	.00	6.88	11.91	.21
FRAGILARIA VAUCHERIAE	10.32	37.39	16.43	21.38	14.20	.64
GOMPHONEMA OLIVACEUM	.00	.00	82.13	27.38	47.42	.82
GOMPHONEMA PARVULUM	.00	74.79	.00	24.93	43.18	.74
GOMPHONEMA TENELLUM	.00	.00	32.85	10.95	18.97	.33
MERIDION CIRCULARE	.00	.00	16.43	5.48	9.48	.16
NAVICULA ARVENSIS	10.32	.00	.00	3.44	5.96	.10
NAVICULA CRYPTOCEPHALA VAR. VENETA	51.59	74.79	49.28	58.55	14.11	1.75
NAVICULA NOTHA	.00	18.70	.00	6.23	10.79	.19
NAVICULA PELLICULOSA	.00	37.39	.00	12.46	21.59	.37
NAVICULA PUPULA VAR. RECTANGULARIS	.00	18.70	.00	6.23	10.79	.19
NAVICULA SECRETA VAR. APICULATA	61.91	37.39	164.26	87.85	67.30	2.62
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	.00	18.70	.00	6.23	10.79	.19
NAVICULA VIRIDULA VAR. AVENACEA	1114.35	2337.14	2463.92	1971.80	745.27	58.89
NITZSCHIA AMPHIBIA	.00	.00	49.28	16.43	28.45	.49
NITZSCHIA APICULATA	30.95	.00	.00	10.32	17.87	.31
NITZSCHIA DISSIPATA	51.59	130.88	82.13	88.20	39.99	2.63
NITZSCHIA FONTICOLA	10.32	37.39	65.70	37.81	27.70	1.13
NITZSCHIA FRUSTULUM	10.32	56.09	.00	22.14	29.85	.66
NITZSCHIA IGNORATA	.00	18.70	.00	6.23	10.79	.19
NITZSCHIA KUTZINGIANA	.00	.00	16.43	5.48	9.48	.16
NITZSCHIA PALEA	41.27	93.49	82.13	72.30	27.46	2.16
NITZSCHIA SP.	41.27	37.39	82.13	53.60	24.79	1.60
RHOICOSPHENIA CURVATA	92.86	18.70	197.11	102.89	89.63	3.07
SKELETONEMA POTAMOS	41.27	.00	.00	13.76	23.83	.41
SURIRELLA OVATA	51.59	56.09	49.28	52.32	3.46	1.56
SYNEDRA AMPHICEPHALA	20.64	.00	16.43	12.35	10.90	.37
UNIDENTIFIED PENNATE DIATOMS	20.64	74.79	49.28	48.23	27.09	1.44
DIVISION TOTAL	2104.89	3758.12	4172.24	3345.08	1093.81	99.90

CHLOROPHYTA						
UNIDENTIFIED FILAMENT	.00	.00	10.35	3.45	5.98	.10
DIVISION TOTAL	.00	.00	10.35	3.45	5.98	.10
TOTAL DENSITY	2104.89	3758.12	4182.59	3348.53	1097.74	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 1.852
VARIANCE = .0009
MAXIMUM INDEX = 3.664
EVENNESS = .505
NO OF SPECIES = 39

SAMPLE STATION: WP02 - MIDDLE
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 06-01-82

TAXON	DENSITY (UNITS/MM2) REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA	.00	96.30	.00	32.10	55.60	.16
ACHNANTHES LANCEOLATA VAR. DUBIA	727.32	674.07	543.33	648.24	94.68	3.17
ACHNANTHES LINEARIS	207.81	385.19	724.44	439.15	262.51	2.15
ACHNANTHES MINUTISSIMA	1142.94	1733.33	2897.78	1924.68	892.93	9.41
AMPHORA PERPUSILLA	207.81	.00	724.44	310.75	373.03	1.52
CALONEIS AMPHISBAENA	.00	192.59	.00	64.20	111.19	.31
COCCONEIS PLACENTULA VAR. LINEATA	207.81	.00	90.56	99.45	104.19	.49
CYCLOTELLA MENEGHINIANA	415.61	96.30	362.22	291.38	171.04	1.42
CYMBELLA AFFINIS	.00	96.30	.00	32.10	55.60	.16
CYMBELLA MICROCEPHALA	.00	192.59	.00	64.20	111.19	.31
CYMBELLA MINUTA VAR. SILESIACA	207.81	192.59	.00	133.47	115.84	.65
FRAGILAREA CONSTRUENS VAR. BINODIS	727.32	.00	.00	242.44	419.92	1.19
FRAGILARIA VAUCHERIAE	.00	96.30	90.56	62.28	54.02	.30
GOMPHONEMA ANGUSTATUM	103.90	.00	.00	34.63	59.99	.17
GOMPHONEMA TENELLUM	.00	96.30	.00	32.10	55.60	.16
GOMPHONEMA SP.	.00	96.30	.00	32.10	55.60	.16
NAVICULA ARVENSIS	207.81	.00	181.11	129.64	113.06	.63
NAVICULA CINCTA	207.81	192.59	271.67	224.02	41.96	1.10
NAVICULA CRYPTOCEPHALA VAR. VENETA	207.81	577.78	181.11	322.23	221.71	1.58
NAVICULA RADIOSA	.00	192.59	.00	64.20	111.19	.31
NAVICULA RHYNCHOCEPHALA	.00	.00	90.56	30.19	52.28	.15

NAVICULA SECRETA VAR. APICULATA	519.52	577.78	543.33	546.88	29.29	2.67
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	311.71	.00	.00	103.90	179.97	.51
NAVICULA VIRIDULA VAR. AVENACEA	10494.23	10785.19	9598.89	10292.77	618.28	50.33
NITZSCHIA ACICULARIS	207.81	192.59	.00	133.47	115.84	.65
NITZSCHIA CAPITELLATA	.00	96.30	.00	32.10	55.60	.16
NITZSCHIA COMMUNIS	.00	96.30	181.11	92.47	90.62	.45
NITZSCHIA DISSIPATA	1766.36	1348.15	1630.00	1581.50	213.28	7.73
NITZSCHIA FONTICOLA	415.61	288.89	362.22	355.57	63.62	1.74
NITZSCHIA FRUSTULUM	.00	.00	271.67	90.56	156.85	.44
NITZSCHIA LINEARIS	.00	.00	181.11	60.37	104.56	.30
NITZSCHIA PALEA	.00	192.59	362.22	184.94	181.23	.90
NITZSCHIA SP.	311.71	192.59	905.56	469.95	381.92	2.30
RHOICOSPHENIA CURVATA	207.81	577.78	543.33	442.97	204.39	2.17
SURIRELLA OVATA	519.52	288.89	181.11	329.84	172.88	1.61
SYNEDRA AMPHICEPHALA	103.90	.00	181.11	95.00	90.88	.46
SYNEDRA DELICATISSIMA	103.90	.00	.00	34.63	59.99	.17
UNIDENTIFIED PENNATE DIATOMS	311.71	96.30	633.89	347.30	270.56	1.70
DIVISION TOTAL	19845.53	19644.44	21733.33	20407.77	1152.37	99.78
CHLOROPHYTA						
UNIDENTIFIED GREEN COCCOID	.00	44.44	.00	14.81	25.66	.07
DIVISION TOTAL	.00	44.44	.00	14.81	25.66	.07
CHRYSOPHYTA						
ANABAENA SP.	.00	44.44	44.44	29.63	25.66	.14
DIVISION TOTAL	.00	44.44	44.44	29.63	25.66	.14
TOTAL DENSITY	19845.53	19733.33	21777.78	20452.21	1149.34	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 2.174
VARIANCE = .0001
MAXIMUM INDEX = 3.689
EVENNESS = .589
NO OF SPECIES = 40

SAMPLE STATION: WP03 - HUNTER
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 06-01-82

TAXON	DENSITY (UNITS/MM2) REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA VAR. DUBIA	76.22	.00	200.67	92.30	101.29	.63
ACHNANTHES LINEARIS	.00	119.70	133.78	84.49	73.51	.58
ACHNANTHES MINUTISSIMA	533.56	478.80	468.22	493.52	35.07	3.39
AMPHORA OVALIS	.00	59.85	.00	19.95	34.55	.14
AMPHORA PERPUSILLA	76.22	179.55	66.89	107.55	62.52	.74
CALONEIS AMPHISBAENA	.00	.00	66.89	22.30	38.62	.15
COCCONEIS PLACENTULA VAR. LINEATA	.00	59.85	.00	19.95	34.55	.14
CYCLOTELLA MENEGHINIANA	228.67	239.40	133.78	200.61	58.13	1.38
CYMBELLA AFFINIS	.00	59.85	.00	19.95	34.55	.14
CYMBELLA SINUATA	.00	.00	133.78	44.59	77.24	.31
DIATOMA VULGARE	.00	.00	66.89	22.30	38.62	.15
FRAGILARIA VAUCHERIAE	381.11	179.55	.00	186.89	190.66	1.28
GOMPHONEMA OLIVACEUM	152.44	59.85	133.78	115.36	48.97	.79
GOMPHONEMA PARVULUM	76.22	119.70	200.67	132.20	63.16	.91
GOMPHONEMA SUBCLAVATUM	.00	119.70	.00	39.90	69.11	.27
NAVICULA CRYPTOCEPHALA VAR. VENETA	533.56	179.55	602.00	438.37	226.74	3.01
NAVICULA HEUFLERI	.00	59.85	133.78	64.54	67.01	.44
NAVICULA NOTHA	152.44	59.85	.00	70.76	76.81	.49
NAVICULA SECRETA VAR. APICULATA	609.78	239.40	401.33	416.84	185.68	2.86
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	.00	.00	133.78	44.59	77.24	.31
NAVICULA VIRIDULA VAR. AVENACEA	7622.22	7780.43	6688.89	7363.85	589.86	50.57
NITZSCHIA APICULATA	.00	.00	66.89	22.30	38.62	.15
NITZSCHIA DISSIPATA	457.33	239.40	133.78	276.84	164.99	1.90
NITZSCHIA FONTICOLA	762.22	837.89	267.56	622.56	309.76	4.27
NITZSCHIA FRUSTULUM	152.44	478.80	.00	210.41	244.61	1.44
NITZSCHIA HUNGARICA	.00	119.70	133.78	84.49	73.51	.58
NITZSCHIA LINEARIS	76.22	119.70	.00	65.31	60.59	.45
NITZSCHIA PALEA	1372.00	2154.58	2207.33	1911.31	467.80	13.12
NITZSCHIA SP.	1219.56	179.55	334.44	577.85	561.10	3.97
RHOICOSPHENIA CURVATA	381.11	239.40	200.67	273.73	94.99	1.88
SURIRELLA OVALIS	152.44	.00	66.89	73.11	76.41	.50
SURIRELLA OVATA	76.22	658.34	334.44	356.34	291.68	2.45
SYNEDRA AMPHICEPHALA	76.22	.00	.00	25.41	44.01	.17
SYNEDRA ULNA	.00	.00	66.89	22.30	38.62	.15
THALASSIOSIRA FLUVIATILIS	76.22	.00	.00	25.41	44.01	.17
DIVISION TOTAL	15244.44	15022.22	13377.78	14548.15	1019.64	99.90
CHLOROPHYTA						
UNIDENTIFIED FILAMENT	.00	.00	44.44	14.81	25.66	.10
DIVISION TOTAL	.00	.00	44.44	14.81	25.66	.10
TOTAL DENSITY	15244.44	15022.22	13422.22	14562.96	994.14	100.00

DIVERSITY INDEX CALCULATIONS

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SHANNON INDEX = 2.070
VARIANCE      =  .0002
MAXIMUM INDEX = 3.584
EVENNESS      =  .578
NO OF SPECIES =    36
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PERIPHYTON DENSITY AND SPECIES DIVERSITY ESTIMATES

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 06-30-82

TAXON	REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
	DENSITY (UNITS/MM2)					
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA VAR. DUBIA	25.20	.00	28.70	17.97	15.66	.23
ACHNANTHES LINEARIS	.00	.00	57.40	19.13	33.14	.24
ACHNANTHES MINUTISSIMA	680.44	668.66	1033.26	794.12	207.19	10.11
AMPHORA PERPUSILLA	50.40	.00	.00	16.80	29.10	.21
COCCONEIS PLACENTULA VAR. LINEATA	.00	238.81	.00	79.60	137.88	1.01
CYCLOTELLA MENEGHINIANA	176.41	.00	57.40	77.94	89.98	.99
DENTICULA ELEGANS	.00	95.52	.00	31.84	55.15	.41
FRAGILARIA VAUCHERIAE	.00	143.28	86.11	76.46	72.13	.97
GOMPHONEMA OLIVACEUM	252.01	764.19	57.40	357.87	365.09	4.56
NAVICULA CRYPTOCEPHALA	25.20	95.52	.00	40.24	49.51	.51
NAVICULA CRYPTOCEPHALA VAR. VENETA	100.81	95.52	258.32	151.55	92.50	1.93
NAVICULA MINUSCULA	50.40	.00	.00	16.80	29.10	.21
NAVICULA MUTICA	25.20	.00	.00	8.40	14.55	.11
NAVICULA SECRETA VAR. APICULATA	252.01	238.81	172.21	221.01	42.77	2.82
NAVICULA VIRIDULA VAR. AVENACEA	2268.12	2817.93	1435.09	2173.71	696.24	27.69
NITZSCHIA ACICULARIS	50.40	191.05	86.11	109.18	73.11	1.39
NITZSCHIA AMPHIBIA	.00	.00	28.70	9.57	16.57	.12
NITZSCHIA APICULATA	.00	191.05	.00	63.68	110.30	.81
NITZSCHIA CAPITELLATA	25.20	.00	86.11	37.10	44.27	.47
NITZSCHIA COMMUNIS	.00	47.76	114.81	54.19	57.67	.69
NITZSCHIA DISSIPATA	151.21	716.42	516.63	461.42	286.62	5.88
NITZSCHIA FONTICOLA	226.81	286.57	430.53	314.64	104.72	4.01
NITZSCHIA FRUSTULUM	151.21	47.76	57.40	85.46	57.15	1.09
NITZSCHIA LINEARIS	100.81	95.52	57.40	84.58	23.68	1.08
NITZSCHIA PALEACEA	25.20	477.62	746.25	416.35	364.41	5.30
NITZSCHIA PALEA	100.81	286.57	86.11	157.83	111.74	2.01
NITZSCHIA SP.	100.81	477.62	373.12	317.18	194.53	4.04
RHOICOSPHENIA CURVATA	504.03	955.23	487.93	649.06	265.27	8.27
RHOPALODIA MUSCULUS	.00	95.52	.00	31.84	55.15	.41
SYNEDRA ACUS	252.01	525.38	172.21	316.53	185.21	4.03
SYNEDRA AMPHICEPHALA	50.40	.00	.00	16.80	29.10	.21
SYNEDRA ULNA	151.21	429.85	200.91	260.66	148.62	3.32
THALASSIOSIRA FLUVIATILIS	50.40	.00	.00	16.80	29.10	.21
UNIDENTIFIED PENNATE DIATOMS	.00	.00	143.51	47.84	82.85	.61
DIVISION TOTAL	5846.70	9982.17	6773.62	7534.17	2170.11	95.96
CHLOROPHYTA						
STIGEOCLONIUM TENUE	.00	213.90	213.90	142.60	123.50	1.82

DIVISION TOTAL	.00	213.90	213.90	142.60	123.50	1.82
CHRYSOPHYTA						
ANABAENA SP.	.00	.00	23.77	7.92	13.72	.10
OSCILLATORIA TENVIS	.00	166.37	.00	55.46	96.05	.71
PHORMIDIUM SP.	.00	190.14	142.60	110.91	98.95	1.41
DIVISION TOTAL	.00	356.51	166.37	174.29	178.39	2.22
TOTAL DENSITY	5846.70	10552.58	7153.89	7851.06	2429.17	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX • 2.781
VARIANCE • .0002
MAXIMUM INDEX • 3.638
EVENNESS • .764
NO OF SPECIES • 38

SAMPLE STATION: WP02 - MIDDLE
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 06-30-82

TAXON	DENSITY (UNITS/MM2) REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA VAR. DUBIA	23.83	12.24	127.81	54.63	63.64	1.71
ACHNANTHES LINEARIS	59.59	.00	.00	19.86	34.40	.62
ACHNANTHES MINUTISSIMA	35.75	36.71	63.90	45.46	15.98	1.42
AMPHORA PERPUSILLA	47.67	.00	31.95	26.54	24.29	.83
COCCONEIS PLACENTULA VAR. LINEATA	.00	12.24	15.98	9.40	8.36	.29
CYCLOTELLA MENEGHINIANA	95.34	85.66	47.93	76.31	25.05	2.39
CYMBELLA LAEVIS	.00	12.24	.00	4.08	7.07	.13
CYMBELLA MINUTA VAR. SILESIACA	.00	.00	31.95	10.65	18.45	.33
DENTICULA SP.	.00	24.47	.00	8.16	14.13	.26
DIATOMA TENUE VAR. ELONGATUM	.00	12.24	.00	4.08	7.07	.13
FRAGILAREA CONSTRUENS VAR. BINODIS	11.92	.00	.00	3.97	6.88	.12
FRAGILARIA CONSTRUENS VAR. VENTER	.00	36.71	.00	12.24	21.20	.38
FRAGILARIA LEPTOSTAURON	.00	.00	31.95	10.65	18.45	.33
FRAGILARIA VAUCHERIAE	.00	73.42	63.90	45.78	39.93	1.43
GOMPHONEMA OLIVACEUM	11.92	.00	.00	3.97	6.88	.12

GOMPHONEMA PARVULUM	.00	12.24	.00	4.08	7.07	.13
NAVICULA CRYPTOCEPHALA	.00	.00	15.98	5.33	9.22	.17
NAVICULA CRYPTOCEPHALA VAR. VENETA	107.26	134.61	79.88	107.25	27.36	3.36
NAVICULA MUTICA VAR. UNDULATA	.00	.00	31.95	10.65	18.45	.33
NAVICULA PUPULA VAR. CAPITATA	.00	.00	15.98	5.33	9.22	.17
NAVICULA RHYNCHOCEPHALA	.00	12.24	.00	4.08	7.07	.13
NAVICULA SECRETA VAR. APICULATA	95.34	134.61	95.86	108.60	22.52	3.40
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	.00	12.24	47.93	20.06	24.90	.63
NAVICULA VIRIDULA VAR. AVENACEA	1549.26	1395.04	2044.96	1663.09	339.58	52.13
NITZSCHIA APICULATA	.00	.00	63.90	21.30	36.90	.67
NITZSCHIA CAPITELLATA	.00	12.24	63.90	25.38	33.92	.80
NITZSCHIA DISSIPATA	95.34	36.71	159.76	97.27	61.55	3.05
NITZSCHIA FONTICOLA	71.50	.00	111.83	61.11	56.64	1.92
NITZSCHIA FRUSTULUM	154.93	208.03	255.62	206.19	50.37	6.46
NITZSCHIA GRACILIS	.00	.00	15.98	5.33	9.22	.17
NITZSCHIA HUNGARICA	11.92	24.47	47.93	28.11	18.28	.88
NITZSCHIA LINEARIS	23.83	48.95	15.98	29.59	17.22	.93
NITZSCHIA PALEACEA	35.75	73.42	31.95	47.04	22.93	1.47
NITZSCHIA PALEA	.00	24.47	63.90	29.46	32.24	.92
NITZSCHIA SIGMOIDEA	35.75	12.24	.00	16.00	18.17	.50
NITZSCHIA SP.	59.59	73.42	.00	44.34	39.02	1.39
RHOICOSPHENIA CURVATA	119.17	171.32	63.90	118.13	53.72	3.70
SURIRELLA OVALIS	47.67	12.24	31.95	30.62	17.75	.96
SURIRELLA OVATA	23.83	36.71	127.81	62.79	56.68	1.97
SYNEDRA AMPHICEPHALA	47.67	.00	.00	15.89	27.52	.50
SYNEDRA ULNA	.00	.00	15.98	5.33	9.22	.17
UNIDENTIFIED PENNATE DIATOMS	23.83	.00	31.95	18.60	16.61	.58
DIVISION TOTAL	2788.67	2741.14	3850.27	3126.69	627.09	98.01
CHLOROPHYTA						
CHLAMYDOMONAS SP.	31.69	15.84	31.69	26.41	9.15	.83
COELASTRUM SP.	15.84	.00	.00	5.28	9.15	.17
UNIDENTIFIED GREEN COCCOID	.00	15.84	.00	5.28	9.15	.17
DIVISION TOTAL	47.53	31.69	31.69	36.97	9.15	1.16
CHRYSOPHYTA						
OSCILLATORIA TENVIS	.00	.00	15.84	5.28	9.15	.17
OSCILLATORIA SP.	15.84	.00	.00	5.28	9.15	.17
PHORMIDIUM SP.	31.69	.00	.00	10.56	18.30	.33
PHACUS SP.	.00	15.84	.00	5.28	9.15	.17
DIVISION TOTAL	47.53	15.84	15.84	26.41	18.30	.83
TOTAL DENSITY	2883.74	2788.67	3897.80	3190.07	614.75	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 2.276
VARIANCE = .0010
MAXIMUM INDEX = 3.892

EVENNESS • .585
NO OF SPECIES • 49

SAMPLE STATION: WPC3 - HUNTER CRK
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 06-30-82

TAXON	DENSITY (UNITS/MM2) REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA	.00	90.17	84.09	58.09	50.40	.45
ACHNANTHES LANCEOLATA VAR. DUBIA	159.30	180.35	84.09	141.24	50.61	1.09
ACHNANTHES LINEARIS	.00	.00	84.09	28.03	48.55	.22
ACHNANTHES MINUTISSIMA	531.00	811.56	840.85	727.80	171.06	5.60
AMPHORA PERPUSILLA	.00	90.17	.00	30.06	52.06	.23
COCCONEIS PEDICULUS	53.10	.00	.00	17.70	30.66	.14
COCCONEIS PLACENTULA VAR. LINEATA	265.50	.00	.00	88.50	153.29	.68
CYCLOTELLA MENEGHINIANA	159.30	315.60	42.04	172.32	137.24	1.33
CYMBELLA MINUTA VAR. SILESIACA	106.20	.00	.00	35.40	61.32	.27
FRAGILARIA VAUCHERIAE	.00	.00	42.04	14.01	24.27	.11
GOMPHONEMA ANGUSTATUM	.00	90.17	.00	30.06	52.06	.23
GOMPHONEMA PARVULUM	106.20	90.17	.00	65.46	57.25	.50
GOMPHONEMA SUBCLAVATUM	.00	.00	84.09	28.03	48.55	.22
GOMPHONEMA SP.	53.10	.00	.00	17.70	30.66	.14
NAVICULA ARVENSIS	159.30	.00	126.13	95.14	84.05	.73
NAVICULA CRYPTOCEPHALA VAR. VENETA	.00	270.52	.00	90.17	156.18	.69
NAVICULA HEUFLERI	.00	90.17	.00	30.06	52.06	.23
NAVICULA LUZONENSIS	53.10	.00	84.09	45.73	42.52	.35
NAVICULA MINIMA	.00	.00	84.09	28.03	48.55	.22
NAVICULA SECRETA VAR. APICULATA	1008.91	450.86	252.26	570.68	392.30	4.39
NAVICULA VIRIDULA VAR. AVENACEA	3345.33	2795.36	4036.08	3392.26	621.69	26.09
NITZSCHIA APICULATA	318.60	676.30	588.60	527.83	186.43	4.06
NITZSCHIA DISSIPATA	424.80	360.69	.00	261.83	229.01	2.01
NITZSCHIA FONTICOLA	265.50	586.12	294.30	381.97	177.38	2.94
NITZSCHIA FRUSTULUM	4832.14	4643.90	2942.98	4139.67	1040.63	31.84
NITZSCHIA HUNGARICA	159.30	495.95	168.17	274.47	191.86	2.11
NITZSCHIA LINEARIS	.00	225.43	210.21	145.21	125.99	1.12
NITZSCHIA PALEACEA	106.20	.00	.00	35.40	61.32	.27
NITZSCHIA PALEA	849.61	90.17	.00	313.26	466.67	2.41
NITZSCHIA SIGMOIDEA	.00	.00	42.04	14.01	24.27	.11
NITZSCHIA TRYBLIONELLA VAR. LEVIDENS	.00	.00	84.09	28.03	48.55	.22
PINNULARIA SP.	.00	.00	84.09	28.03	48.55	.22
RHOICOSPHENIA CURVATA	531.00	135.26	84.09	250.12	244.60	1.92
RHOPALODIA GIBBA VAR. VENTRICOSA	.00	.00	84.09	28.03	48.55	.22
SURIRELLA OVALIS	318.60	495.95	420.43	411.66	89.00	3.17
SURIRELLA OVATA	106.20	450.86	252.26	269.77	173.00	2.08
SYNEDRA DELICATISSIMA	.00	45.09	.00	15.03	26.03	.12
THALASSIOSIRA FLUVIATILIS	265.50	90.17	.00	118.56	135.01	.91
UNIDENTIFIED PENNATE DIATOMS	106.20	.00	.00	35.40	61.32	.27

DIVISION TOTAL	14284.02	13571.00	11099.23	12984.75	1671.37	99.88
CYANOPHYTA						
OSCILLATORIA TENVIS	.00	23.77	23.77	15.84	13.72	.12
DIVISION TOTAL	.00	23.77	23.77	15.84	13.72	.12
TOTAL DENSITY	14284.02	13594.77	11122.99	13000.59	1662.17	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 2.356
VARIANCE = .0002
MAXIMUM INDEX = 3.689
EVENNESS = .639
NO OF SPECIES = 40

PERIPHYTON DENSITY AND SPECIES DIVERSITY ESTIMATES

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 07-29-82

TAXON	DENSITY (UNITS/MM2) REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA VAR. DUBIA	410.61	367.68	199.81	326.03	111.40	4.88
ACHNANTHES LINEARIS	.00	43.26	49.95	31.07	27.11	.47
ACHNANTHES MINUTISSIMA	246.36	281.16	249.77	259.10	19.19	3.88
AMPHORA PERPUSILLA	41.06	.00	124.88	55.31	63.65	.83
COCCONEIS PEDICULUS	20.53	.00	.00	6.84	11.85	.10
COCCONEIS PLACENTULA VAR. LINEATA	554.32	216.28	324.70	365.10	172.60	5.47
CYCLOTELLA MENEGHINIANA	82.12	108.14	49.95	80.07	29.15	1.20
CYMBELLA SINUATA	.00	.00	49.95	16.65	28.84	.25
DIATOMA VULGARE	143.71	129.77	74.93	116.14	36.36	1.74
FRAGILARIA CONSTRUENS VAR. BINODIS	.00	.00	74.93	24.98	43.26	.37
FRAGILARIA CONSTRUENS VAR. VENTER	20.53	.00	.00	6.84	11.85	.10
FRAGILARIA VAUCHERIAE	164.24	108.14	149.86	140.75	29.14	2.11
GOMPHONEMA OLIVACEUM	143.71	216.28	124.88	161.63	48.26	2.42
GOMPHONEMA PARVULUM	41.06	43.26	.00	28.11	24.36	.42
HANTZSCHIA AMPHIOXYS	.00	21.63	.00	7.21	12.49	.11
NAVICULA CRYPTOCEPHALA	41.06	.00	.00	13.69	23.71	.20
NAVICULA CRYPTOCEPHALA VAR. VENETA	20.53	194.65	424.60	213.26	202.68	3.19
NAVICULA MINIMA	41.06	.00	49.95	30.34	26.65	.45
NAVICULA NOTHA	.00	.00	49.95	16.65	28.84	.25
NAVICULA SECRETA VAR. APICULATA	.00	216.28	124.88	113.72	108.57	1.70
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	20.53	.00	49.95	23.49	25.11	.35
NAVICULA VIRIDULA VAR. AVENACEA	615.91	1211.17	724.32	850.47	317.05	12.73
NAVICULA SP.	20.53	.00	.00	6.84	11.85	.10
NITZSCHIA APICULATA	41.06	151.40	24.98	72.48	68.82	1.09
NITZSCHIA CAPITELLATA	20.53	43.26	74.93	46.24	27.32	.69
NITZSCHIA COMMUNIS	20.53	.00	.00	6.84	11.85	.10
NITZSCHIA DISSIPATA	205.30	410.93	124.88	247.04	147.52	3.70
NITZSCHIA FONTICOLA	246.36	43.26	324.70	204.77	145.26	3.07
NITZSCHIA FRUSTULUM	143.71	21.63	124.88	96.74	65.73	1.45
NITZSCHIA HUNGARICA	.00	.00	24.98	8.33	14.42	.12
NITZSCHIA PALEACEA	41.06	43.26	49.95	44.76	4.63	.67
NITZSCHIA PALEA	205.30	346.05	124.88	225.41	111.95	3.38
NITZSCHIA SIGMOIDEA	.00	.00	49.95	16.65	28.84	.25
NITZSCHIA SP.	.00	173.02	74.93	82.65	86.77	1.24
RHOICOSPHENIA CURVATA	1129.17	1297.68	1323.76	1250.20	105.63	18.72
RHOPALODIA MUSCULUS	.00	21.63	.00	7.21	12.49	.11
STEPHANODISCUS SP.	41.06	.00	.00	13.69	23.71	.20
SURIRELLA OVATA	.00	.00	24.98	8.33	14.42	.12
SYNEDRA ACUS	41.06	.00	74.93	38.66	37.52	.58
SYNEDRA AMPHICEPHALA	.00	86.51	.00	28.84	49.95	.43
SYNEDRA DELICATISSIMA	266.89	432.56	224.79	308.08	109.84	4.61
SYNEDRA ULNA	164.24	346.05	299.72	270.00	94.48	4.04
THALASSIOSIRA FLUVIATILIS	.00	86.51	24.98	37.16	44.52	.56

TAXON	REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
UNIDENTIFIED PENNATE DIATOMS	82.12	.00	.00	27.37	47.41	.41
DIVISION TOTAL	5276.29	6661.44	5869.52	5935.75	694.94	88.88
CHLOROPHYTA						
CHLAMYDOMONAS SP.	.00	.00	69.88	23.29	40.34	.35
MOUGEOTIA SP.	.00	46.58	163.04	69.88	83.98	1.05
OEDOGONIUM SP.	47.53	.00	.00	15.84	27.44	.24
STIGECCLONIUM TENUE	617.94	628.88	395.96	547.59	131.43	8.20
TETRAEDRON MINIMUM	23.77	.00	.00	7.92	13.72	.12
DIVISION TOTAL	689.25	675.46	628.88	664.53	31.63	9.95
CHRYSOPHYTA						
ANABAENA SP.	.00	.00	23.29	7.76	13.45	.12
LYNGBYA SP.	.00	46.58	.00	15.53	26.89	.23
OSCILLATORIA TENVIS	.00	.00	23.29	7.76	13.45	.12
OSCILLATORIA SP.	.00	.00	46.58	15.53	26.89	.23
PHORMIDIUM SP.	71.30	.00	.00	23.77	41.17	.36
PHACUS SP.	.00	23.29	.00	7.76	13.45	.12
DIVISION TOTAL	71.30	69.88	93.17	78.11	13.06	1.17
TOTAL DENSITY	6036.84	7406.77	6591.56	6678.39	689.08	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 3.085
VARIANCE = .0002
MAXIMUM INDEX = 4.007
EVENNESS = .770
NO OF SPECIES = 55

SAMPLE STATION: WP02 - MIDDLE
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 07-29-82

TAXON	DENSITY (UNITS/MM2) REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE

BACILLARIOPHYTA

BACILLARIOPHYTA	.00	19.14	.00	6.38	11.05	.21
ACHNANTHES LANCEOLATA	11.07	.00	.00	3.69	6.39	.12
ACHNANTHES LANCEOLATA VAR. DUBIA	132.80	382.87	92.79	202.82	157.21	6.81
ACHNANTHES LINEARIS	22.13	.00	7.14	9.76	11.30	.33
ACHNANTHES MINUTISSIMA	44.27	220.15	46.40	103.60	100.94	3.48
AMPHORA PERPUSILLA	44.27	.00	10.71	18.32	23.10	.61
CALONEIS SP.	.00	19.14	.00	6.38	11.05	.21
COCCONEIS PLACENTULA VAR. LINEATA	188.13	181.86	74.95	148.31	63.61	4.98
CYCLOTELLA MENEGHINIANA	66.40	47.86	10.71	41.65	28.36	1.40
CYMBELLA MINUTA VAR. SILESIACA	11.07	.00	.00	3.69	6.39	.12
CYMBELLA SINUATA	.00	19.14	.00	6.38	11.05	.21
DIATOMA VULGARE	77.46	.00	.00	25.82	44.72	.87
FRAGILAREA CONSTRUENS VAR. BINODIS	.00	.00	21.41	7.14	12.36	.24
FRAGILARIA VAUCHERIAE	77.46	153.15	14.28	81.63	69.53	2.74
GOMPHONEMA OLIVACEUM	55.33	143.58	28.55	75.82	60.19	2.54
GOMPHONEMA PARVULUM	33.20	210.58	74.95	106.24	92.74	3.56
GOMPHONEMA SUBCLAVATUM	.00	.00	10.71	3.57	6.18	.12
HANTZSCHIA AMPHIOXYS	22.13	.00	.00	7.38	12.78	.25
NAVICULA CRYPTOCEPHALA VAR. VENETA	166.00	67.00	17.84	83.61	75.46	2.81
NAVICULA MINIMA	44.27	9.57	7.14	20.33	20.77	.68
NAVICULA NOTHA	22.13	.00	3.57	8.57	11.88	.29
NAVICULA SECRETA VAR. APICULATA	44.27	.00	21.41	21.89	22.14	.73
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	22.13	.00	.00	7.38	12.78	.25
NAVICULA VIRIDULA VAR. AVENACEA	675.05	239.29	60.67	325.00	316.03	10.91
NITZSCHIA APICULATA	.00	.00	7.14	2.38	4.12	.08
NITZSCHIA CAPITELLATA	22.13	.00	.00	7.38	12.78	.25
NITZSCHIA COMMUNIS	22.13	19.14	.00	13.76	12.01	.46
NITZSCHIA DISSIPATA	243.46	47.86	32.12	107.81	117.74	3.62
NITZSCHIA FONTICOLA	154.93	181.86	24.98	120.59	83.89	4.05
NITZSCHIA FRUSTULUM	11.07	95.72	32.12	46.30	44.07	1.55
NITZSCHIA LINEARIS	.00	.00	3.57	1.19	2.06	.04
NITZSCHIA PALEACEA	11.07	19.14	14.28	14.83	4.07	.50
NITZSCHIA PALEA	55.33	57.43	21.41	44.73	20.22	1.50
NITZSCHIA SP.	55.33	.00	.00	18.44	31.95	.62
RHOICOSPHENIA CURVATA	531.19	478.59	203.43	404.40	176.02	13.57
RHOPALODIA MUSCULUS	22.13	.00	.00	7.38	12.78	.25
SURIRELLA OVATA	11.07	19.14	3.57	11.26	7.79	.38
SYNEDRA DELICATISSIMA	166.00	57.43	.00	74.48	84.30	2.50
SYNEDRA FASCICULATA VAR. TRUNCATA	.00	.00	3.57	1.19	2.06	.04
SYNEDRA ULNA	77.46	67.00	10.71	51.72	35.91	1.74
THALASSIOSIRA FLUVIATILIS	.00	9.57	.00	3.19	5.53	.11
UNIDENTIFIED PENNATE DIATOMS	.00	38.29	24.98	21.09	19.44	.71
DIVISION TOTAL	3142.86	2804.52	885.09	2277.49	1217.66	76.42

CHLOROPHYTA

ANKISTRODESMUS SP.	47.62	.00	23.29	23.64	23.81	.79
CHLAMYDOMONAS SP.	47.62	47.53	.00	31.72	27.47	1.06
MOUGEOTIA SP.	47.62	47.53	.00	31.72	27.47	1.06
STIGEOCLONIUM TENUE	690.48	689.25	395.96	591.89	169.69	19.86
DIVISION TOTAL	833.33	784.31	419.25	678.97	226.25	22.78

CHRYSOPHYTA

OSCILLATORIA SP.	23.81	.00	.00	7.94	13.75	.27
PHORMIDIUM SP.	.00	23.77	.00	7.92	13.72	.27

TRACHELEMONAS SP.	23.81	.00	.00	7.94	13.75	.27
DIVISION TOTAL	47.62	23.77	.00	23.80	23.81	.80
TOTAL DENSITY	4023.81	3612.60	1304.34	2980.25	1465.87	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 2.950
VARIANCE = .0005
MAXIMUM INDEX = 3.892
EVENNESS = .758
NO OF SPECIES = 49

PERIPHYTON DENSITY AND SPECIES DIVERSITY ESTIMATES

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 09-02-82

	DENSITY (UNITS/MM2)					
TAXON	REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA VAR. DUBIA	65.79	95.02	33.90	64.90	30.57	.49
ACHNANTHES LINEARIS	65.79	126.70	169.49	120.66	52.11	.91
ACHNANTHES MINUTISSIMA	504.41	1013.58	576.28	698.09	275.58	5.26
AMPHORA PERPUSILLA	153.52	95.02	440.68	229.74	185.01	1.73
COCCONEIS PEDICULUS	.00	.00	33.90	11.30	19.57	.09
COCCONEIS PLACENTULA VAR. LINEATA	87.72	285.07	203.39	192.06	99.16	1.45
CYCLOTELLA MENEGHINIANA	.00	95.02	33.90	42.97	48.16	.32
CYMBELLA AFFINIS	43.86	126.70	.00	56.85	64.34	.43
CYMBELLA MINUTA VAR. SILESIACA	87.72	31.67	.00	39.80	44.42	.30
CYMBELLA SINUATA	.00	.00	67.80	22.60	39.14	.17
FRAGILARIA VAUCHERIAE	87.72	95.02	271.19	151.31	103.88	1.14
GOMPHONEMA OLIVACEUM	175.45	411.77	305.09	297.43	118.35	2.24
GOMPHONEMA PARVULUM	175.45	158.37	.00	111.27	96.74	.84
GOMPHONEMA TENELLUM	.00	.00	33.90	11.30	19.57	.09
GOMPHONEMA SP.	43.86	31.67	.00	25.18	22.64	.19
NAVICULA ARVENSIS	87.72	63.35	203.39	118.15	74.82	.89
NAVICULA CRYPTOCEPHALA	21.93	506.79	.00	176.24	286.47	1.33
NAVICULA CRYPTOCEPHALA VAR. VENETA	833.37	1773.76	610.17	1072.43	617.53	8.08
NAVICULA HEUFLERI	482.48	791.86	237.29	503.87	277.90	3.80
NAVICULA MINIMA	.00	95.02	169.49	88.17	84.95	.66
NAVICULA MUTICA	43.86	.00	.00	14.62	25.32	.11
NAVICULA PELLICULOSA	43.86	.00	.00	14.62	25.32	.11
NAVICULA SALINARUM VAR. INTERMEDIA	43.86	.00	.00	14.62	25.32	.11
NAVICULA SECRETA VAR. APICULATA	548.27	570.14	203.39	440.60	205.72	3.32
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	.00	63.35	.00	21.12	36.57	.16
NAVICULA VIRIDULA VAR. AVENACEA	2193.08	3167.43	3389.86	2916.79	636.54	21.97
NITZSCHIA AMPHIBIA	.00	31.67	.00	10.56	18.29	.08
NITZSCHIA APICULATA	65.79	95.02	33.90	64.90	30.57	.49
NITZSCHIA DENTICULA	.00	.00	33.90	11.30	19.57	.09
NITZSCHIA DISSIPATA	1798.32	2438.92	1322.04	1853.10	560.45	13.96
NITZSCHIA FONTICOLA	482.48	506.79	101.70	363.65	227.19	2.74
NITZSCHIA FRUSTULUM	635.99	2248.87	1389.84	1424.90	807.01	10.73
NITZSCHIA HUNGARICA	65.79	.00	.00	21.93	37.99	.17
NITZSCHIA IGNORATA	.00	31.67	.00	10.56	18.29	.08
NITZSCHIA PALEA	65.79	380.09	33.90	159.93	191.33	1.20
NITZSCHIA SP.	109.65	63.35	.00	57.67	55.05	.43
RHOICOSPHENIA CURVATA	767.58	981.90	576.28	775.25	202.92	5.84
SURIRELLA OVATA	21.93	31.67	.00	17.87	16.22	.13
SYNEDRA ACUS	.00	.00	33.90	11.30	19.57	.09
SYNEDRA MINUSCULA	43.86	.00	.00	14.62	25.32	.11
SYNEDRA ULNA	.00	.00	33.90	11.30	19.57	.09
UNIDENTIFIED PENNATE DIATOMS	87.72	158.37	.00	82.03	79.34	.62

DIVISION TOTAL	9934.64	16565.66	10542.45	12347.58	3665.58	93.02
CHLOROPHYTA						
STIGEOCLONIUM TENUE	190.14	784.31	879.38	617.94	373.53	4.66
UNIDENTIFIED FILAMENT	.00	23.77	.00	7.92	13.72	.06
DIVISION TOTAL	190.14	808.08	879.38	625.87	379.03	4.71
CHRYSOPHYTA						
CHROOCOCCUS SP.	47.53	.00	.00	15.84	27.44	.12
LYNGBYA SP.	261.44	261.44	308.97	277.28	27.44	2.09
PHORMIDIUM SP.	.00	.00	23.77	7.92	13.72	.06
DIVISION TOTAL	308.97	261.44	332.74	301.05	36.30	2.27
TOTAL DENSITY	10433.75	17635.18	11754.57	13274.50	3833.77	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 2.774
VARIANCE = .0001
MAXIMUM INDEX = 3.850
EVENNESS = .721
NO OF SPECIES = 47

SAMPLE STATION: WP02 - MIDDLE
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 07-02-82

TAXON	DENSITY (UNITS/MM2) REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA VAR. DUBIA	106.88	50.51	74.57	77.32	28.29	.91
ACHNANTHES LINEARIS	30.54	50.51	.00	27.01	25.44	.32
ACHNANTHES MINUTISSIMA	213.77	631.31	410.15	418.41	208.90	4.92
AMPHORA OVALIS	30.54	.00	.00	10.18	17.63	.12
AMPHORA OVALIS VAR. AFFINIS	.00	50.51	.00	16.84	29.16	.20
AMPHORA PERPUSILLA	229.03	328.28	149.15	235.49	89.74	2.77

COCCONEIS PLACENTULA VAR. EUGLYPTA	.00	50.51	.00	16.84	29.16	.20
COCCONEIS PLACENTULA VAR. LINEATA	167.96	353.54	447.44	322.98	142.22	3.80
CYCLOTELLA MENEGHINIANA	15.27	50.51	74.57	46.78	29.83	.55
CYMBELLA AFFINIS	.00	25.25	149.15	58.13	79.83	.68
CYMBELLA CYMBIFORMIS	.00	50.51	.00	16.84	29.16	.20
CYMBELLA MINUTA VAR. SILESIACA	.00	25.25	.00	8.42	14.58	.10
CYMBELLA SINUATA	15.27	126.26	37.29	59.61	58.77	.70
DIATOMA TENUE VAR. ELONGATUM	.00	50.51	111.86	54.12	56.02	.64
FRAGILARIA LEPTOSTAURON	.00	25.25	.00	8.42	14.58	.10
FRAGILARIA VAUCHERIAE	152.69	75.76	74.57	101.01	44.76	1.19
GOMPHONEMA OLIVACEUM	106.88	75.76	37.29	73.31	34.86	.86
GOMPHONEMA PARVULUM	.00	126.26	111.86	79.37	69.12	.93
GOMPHONEMA SP.	15.27	.00	.00	5.09	8.82	.06
NAVICULA ARVENSIS	30.54	101.01	74.57	68.71	35.60	.81
NAVICULA CRYPTOCEPHALA VAR. VENETA	458.07	959.60	559.30	658.99	265.21	7.75
NAVICULA HEUFLERI	351.19	681.82	857.60	630.20	257.12	7.41
NAVICULA MINIMA	.00	176.77	.00	58.92	102.06	.69
NAVICULA MUTICA VAR. UNDULATA	.00	50.51	.00	16.84	29.16	.20
NAVICULA NOTHA	.00	.00	74.57	24.86	43.06	.29
NAVICULA SALINARUM VAR. INTERMEDIA	91.61	50.51	111.86	84.66	31.26	1.00
NAVICULA SECRETA VAR. APICULATA	122.15	303.03	149.15	191.44	97.58	2.25
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	.00	50.51	.00	16.84	29.16	.20
NAVICULA VIRIDULA VAR. AVENACEA	1526.90	2525.25	3765.96	2606.04	1121.72	30.63
NAVICULA SP.	30.54	25.25	.00	18.60	16.32	.22
NITZSCHIA APICULATA	30.54	101.01	37.29	56.28	38.89	.66
NITZSCHIA DISSIPATA	183.23	631.31	596.59	470.38	249.28	5.53
NITZSCHIA FONTICOLA	76.34	25.25	74.57	58.72	29.00	.69
NITZSCHIA FRUSTULUM	488.61	707.07	932.17	709.28	221.79	8.34
NITZSCHIA PALEA	76.34	25.25	111.86	71.15	43.54	.84
NITZSCHIA TRYBLIONELLA VAR. LEVIDENS	15.27	.00	.00	5.09	8.82	.06
NITZSCHIA SP.	.00	50.51	.00	16.84	29.16	.20
RHOICOSPHENIA CURVATA	396.99	732.32	1155.89	761.74	380.30	8.95
SURIRELLA OVATA	30.54	126.26	74.57	77.12	47.91	.91
SYNEDRA DELICATISSIMA	15.27	.00	37.29	17.52	18.74	.21
SYNEDRA FASCICULATA	15.27	25.25	.00	13.51	12.72	.16
SYNEDRA MINUSCULA	183.23	50.51	.00	77.91	94.64	.92
SYNEDRA SP.	15.27	.00	.00	5.09	8.82	.06
THALASSIOSIRA FLUVIATILIS	15.27	.00	.00	5.09	8.82	.06
UNIDENTIFIED PENNATE DIATOMS	15.27	75.76	.00	30.34	40.07	.36
DIVISION TOTAL	5252.53	9621.21	10291.15	8388.29	2736.24	98.60
CHLOROPHYTA						
STIGEOCLONIUM TENUE	23.77	95.07	142.60	87.15	59.81	1.02
DIVISION TOTAL	23.77	95.07	142.60	87.15	59.81	1.02
CHRYSOPHYTA						
LYNGBYA SP.	23.77	.00	47.53	23.77	23.77	.28
OSCILLATORIA TENUIS	23.77	.00	.00	7.92	13.72	.09
DIVISION TOTAL	47.53	.00	47.53	31.69	27.44	.37
TOTAL DENSITY	5323.83	9716.28	10481.28	8507.13	2783.23	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 2.691
VARIANCE = .0002
MAXIMUM INDEX = 3.871
EVENNESS = .695
NO OF SPECIES = 48

SAMPLE STATION: WP03 - HUNTER
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 03-02-82

TAXON	DENSITY (UNITS/MM2) REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA VAR. DUBIA	12.92	.00	.00	4.31	7.46	.41
COCCONEIS PLACENTULA VAR. EUGLYPTA	.00	6.61	.00	2.20	3.82	.21
COCCONEIS PLACENTULA VAR. LINEATA	710.57	667.76	968.29	782.21	162.57	74.42
CYMBELLA AFFINIS	.00	13.22	.00	4.41	7.63	.42
DIATOMA VULGARE	6.46	.00	.00	2.15	3.73	.20
GOMPHONEMA INTRICATUM	.00	6.61	.00	2.20	3.82	.21
GOMPHONEMA OLIVACEUM	12.92	46.28	87.15	48.78	37.18	4.64
GOMPHONEMA PARVULUM	6.46	13.22	.00	6.56	6.61	.62
GOMPHONEMA SUBCLAVATUM	.00	6.61	.00	2.20	3.82	.21
GOMPHONEMA TENELLUM	.00	.00	19.37	6.46	11.18	.61
NAVICULA CRYPTOCEPHALA VAR. VENETA	.00	13.22	.00	4.41	7.63	.42
NAVICULA HEUFLERI	6.46	26.45	19.37	17.42	10.13	1.66
NAVICULA SECRETA VAR. APICULATA	.00	.00	19.37	6.46	11.18	.61
NAVICULA VIRIDULA VAR. AVENACEA	.00	.00	29.05	9.68	16.77	.92
NITZSCHIA APICULATA	.00	26.45	.00	8.82	15.27	.84
NITZSCHIA DISSIPATA	.00	.00	29.05	9.68	16.77	.92
NITZSCHIA FONTICOLA	25.84	13.22	19.37	19.48	6.31	1.85
NITZSCHIA FRUSTULUM	51.68	52.89	29.05	44.54	13.43	4.24
RHOICOSPHENIA CURVATA	6.46	26.45	.00	10.97	13.79	1.04
DIVISION TOTAL	839.77	918.99	1220.04	992.94	200.63	94.47
CHLOROPHYTA						
CHLAMYDOMONAS SP.	.00	7.92	.00	2.64	4.57	.25
OEDOGONIUM SP.	79.22	.00	15.84	31.69	41.92	3.02
STIGEOCLONIUM TENUE	.00	.00	31.69	10.56	18.30	1.01
DIVISION TOTAL	79.22	7.92	47.53	44.89	35.72	4.27

CHRYSOPHYTA

ANABAENA SP.	.00	15.84	.00	5.28	9.15	.50
CHROOCOCCUS SP.	15.84	.00	.00	5.28	9.15	.50
LYNGBYA SP.	7.92	.00	.00	2.64	4.57	.25
DIVISION TOTAL	23.77	15.84	.00	13.20	12.10	1.26
TOTAL DENSITY	942.76	942.76	1267.58	1051.03	187.53	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 1.262
VARIANCE = .0028
MAXIMUM INDEX = 3.219
EVENNESS = .392
NO OF SPECIES = 25

PERIPHYTON DENSITY AND SPECIES DIVERSITY ESTIMATES

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 10-04-82

	DENSITY (UNITS/MM2)					
TAXON	REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA VAR. DUBIA	26.09	54.32	52.41	44.27	15.78	.51
ACHNANTHES MINUTISSIMA	1487.00	2064.34	2646.68	2066.01	579.84	23.73
AMPHORA PERPUSILLA	234.79	108.65	131.02	158.15	67.30	1.82
COCCONEIS PLACENTULA VAR. LINEATA	104.35	135.81	52.41	97.52	42.12	1.12
CYCLOTELLA MENEGHINIANA	26.09	.00	.00	8.70	15.06	.10
CYMBELLA AFFINIS	26.09	.00	.00	8.70	15.06	.10
CYMBELLA SINUATA	.00	27.16	.00	9.05	15.68	.10
FRAGILARIA VAUCHERIAE	26.09	.00	183.43	69.84	99.24	.80
GOMPHONEMA OLIVACEUM	26.09	81.49	78.61	62.06	31.19	.71
GOMPHONEMA PARVULUM	182.61	81.49	314.46	192.85	116.82	2.21
GOMPHONEMA TENELLUM	.00	.00	52.41	17.47	30.26	.20
GOMPHONEMA SP.	.00	.00	26.20	8.73	15.13	.10
NAVICULA ARVENSIS	.00	108.65	26.20	44.95	56.70	.52
NAVICULA CRYPTOCEPHALA VAR. VENETA	234.79	597.57	262.05	364.80	202.04	4.19
NAVICULA HEUFLERI	391.32	271.62	288.25	317.06	64.84	3.64
NAVICULA MINIMA	130.44	27.16	26.20	61.27	59.91	.70
NAVICULA NOTHA	130.44	271.62	288.25	230.10	86.71	2.64
NAVICULA SECRETA VAR. APICULATA	234.79	298.79	288.25	273.94	34.31	3.15
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	.00	27.16	26.20	17.79	15.41	.20
NAVICULA VIRIDULA VAR. AVENACEA	2608.78	2743.40	1624.69	2325.62	610.74	26.71
NITZSCHIA DISSIPATA	1304.39	1385.28	2174.99	1621.55	481.00	18.62
NITZSCHIA FRUSTULUM	391.32	543.25	445.48	460.01	77.00	5.28
NITZSCHIA LINEARIS	.00	.00	26.20	8.73	15.13	.10
NITZSCHIA PALEA	.00	.00	26.20	8.73	15.13	.10
RHOICOSPHENIA CURVATA	156.53	271.62	131.02	186.39	74.91	2.14
SURIRELLA OVATA	26.09	27.16	26.20	26.48	.59	.30
DIVISION TOTAL	7748.07	9126.56	9197.86	8690.83	817.23	99.82
CYANOPHYTA						
OSCILLATORIA TENVIS	47.53	.00	.00	15.84	27.44	.18
DIVISION TOTAL	47.53	.00	.00	15.84	27.44	.18
TOTAL DENSITY	7795.60	9126.56	9197.86	8706.67	789.82	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 2.169
VARIANCE = .0002
MAXIMUM INDEX = 3.296
EVENNESS = .658
NO OF SPECIES = 27

SAMPLE STATION: WP02 - MIDDLE
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 10-04-82

TAXON	DENSITY (UNITS/MM2) REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA	.00	21.91	.00	7.30	12.65	.18
ACHNANTHES LANCEOLATA VAR. DUBIA	45.82	65.74	87.44	66.33	20.81	1.68
ACHNANTHES LINEARIS	15.27	.00	.00	5.09	8.82	.13
ACHNANTHES MINUTISSIMA	336.03	482.10	227.33	348.49	127.84	8.82
AMPHORA PERPUSILLA	106.92	153.40	104.92	121.75	27.43	3.08
COCCONEIS PEDICULUS	15.27	.00	.00	5.09	8.82	.13
COCCONEIS PLACENTULA VAR. LINEATA	160.38	131.48	139.90	143.92	14.86	3.64
CYCLOTELLA MENEGHINIANA	22.91	.00	34.97	19.30	17.77	.49
CYMBELLA AFFINIS	7.64	.00	.00	2.55	4.41	.06
CYMBELLA MINUTA VAR. SILESIACA	15.27	21.91	.00	12.40	11.24	.31
CYMBELLA SINUATA	15.27	21.91	.00	12.40	11.24	.31
FRAGILAREA CONSTRUENS VAR. BINODIS	38.19	.00	.00	12.73	22.05	.32
FRAGILARIA CONSTRUENS VAR. VENTER	.00	21.91	.00	7.30	12.65	.18
FRAGILARIA LEPTOSTAURON	.00	43.83	.00	14.61	25.30	.37
FRAGILARIA VAUCHERIAE	15.27	109.57	34.97	53.27	49.74	1.35
FRUSTULIA RHOMBOIDES	.00	.00	34.97	11.66	20.19	.30
GOMPHONEMA OLIVACEUM	38.19	43.83	.00	27.34	23.84	.69
GOMPHONEMA PARVULUM	84.01	43.83	87.44	71.76	24.25	1.82
GOMPHONEMA TENELLUM	15.27	.00	.00	5.09	8.82	.13
HANTZSCHIA AMPHIOXYS	.00	21.91	.00	7.30	12.65	.18
NAVICULA ARVENSIS	22.91	.00	.00	7.64	13.23	.19
NAVICULA CRYPTOCEPHALA VAR. VENETA	84.01	175.31	244.82	168.05	80.65	4.25
NAVICULA HEUFLERI	91.64	131.48	69.95	97.69	31.21	2.47
NAVICULA MINIMA	38.19	.00	.00	12.73	22.05	.32
NAVICULA MUTICA	7.64	.00	.00	2.55	4.41	.06
NAVICULA MUTICA VAR. UNDULATA	.00	21.91	.00	7.30	12.65	.18
NAVICULA ROTHA	38.19	.00	104.92	47.70	53.11	1.21
NAVICULA PUPULA	.00	43.83	.00	14.61	25.30	.37
NAVICULA SALINARUM VAR. INTERMEDIA	45.82	.00	87.44	44.42	43.73	1.12
NAVICULA SECRETA VAR. APICULATA	91.64	219.14	209.85	173.54	71.08	4.39
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	15.27	.00	69.95	28.41	36.78	.72
NAVICULA VIRIDULA VAR. AVENACEA	763.71	2191.37	1748.72	1567.93	730.80	39.70
NITZSCHIA AMPHIBIA	7.64	.00	.00	2.55	4.41	.06

CYMBELLA AFFINIS	.00	.93	2.49	1.14	1.26	.12
DENTICULA ELEGANS	8.15	.00	4.14	4.10	4.07	.44
ENTOMONEIS ORNATA	.00	.93	.00	.31	.54	.03
FRAGILAREA CONSTRUENS VAR. BINODIS	.00	6.50	.00	2.17	3.76	.23
FRAGILARIA LEPTOSTAURON	4.07	3.72	.00	2.60	2.26	.28
FRAGILARIA VAUCHERIAE	8.15	.00	3.31	3.82	4.10	.41
FRUSTULIA RHOMBOIDES	.00	1.86	.00	.62	1.07	.07
GOMPHONEMA OLIVACEUM	40.74	25.09	16.57	27.47	12.26	2.94
GOMPHONEMA PARVULUM	89.64	3.72	24.03	39.13	44.91	4.19
GOMPHONEMA TENELLUM	24.45	.93	4.97	10.12	12.57	1.08
GOMPHONEMA SP.	.00	2.79	.00	.93	1.61	.10
NAVICULA ARVENSIS	12.22	.00	4.14	5.46	6.22	.58
NAVICULA CRYPTOCEPHALA VAR. VENETA	57.04	4.65	6.63	22.77	29.69	2.44
NAVICULA HEUFLERI	85.56	18.58	15.74	39.96	39.52	4.28
NAVICULA MINIMA	8.15	1.86	.00	3.34	4.27	.36
NAVICULA MUTICA	.00	1.86	.00	.62	1.07	.07
NAVICULA MUTICA VAR. UNDULATA	.00	.00	.83	.28	.48	.03
NAVICULA NOTHA	36.67	7.43	2.49	15.53	18.47	1.66
NAVICULA PUPULA	.00	.00	2.49	.83	1.44	.09
NAVICULA PUPULA VAR. CAPITATA	.00	.93	.00	.31	.54	.03
NAVICULA SALINARUM VAR. INTERMEDIA	.00	2.79	.00	.93	1.61	.10
NAVICULA SECRETA VAR. APICULATA	77.41	9.29	14.09	33.60	38.02	3.60
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	8.15	.00	.00	2.72	4.70	.29
NAVICULA VIRIDULA VAR. AVENACEA	110.01	92.92	53.86	85.59	28.78	9.17
NITZSCHIA APICULATA	.00	6.50	.83	2.44	3.54	.26
NITZSCHIA DISSIPATA	256.68	18.58	31.49	102.25	133.90	10.96
NITZSCHIA FRUSTULUM	293.35	34.38	40.60	122.78	147.76	13.16
NITZSCHIA HUNGARICA	.00	.93	.00	.31	.54	.03
NITZSCHIA SP.	.00	3.72	.00	1.24	2.15	.13
PINNULARIA BREBISSONII	.00	2.79	.00	.93	1.61	.10
RHOICOSPHENIA CURVATA	101.86	78.98	82.86	87.90	12.24	9.42
RHOPALODIA MUSCULUS	8.15	2.79	1.66	4.20	3.47	.45
STAURONEIS ANICEPS	.00	.93	.00	.31	.54	.03
STEPHANODISCUS SP.	.00	.93	1.66	.86	.83	.09
SURIRELLA OVATA	4.07	1.86	.83	2.25	1.66	.24
SYNEDRA ACUS	4.07	.00	.00	1.36	2.35	.15
SYNEDRA ULNA	.00	.93	.00	.31	.54	.03
THALASSIOSIRA FLUVIATILIS	8.15	.00	.00	2.72	4.70	.29
UNIDENTIFIED PENNATE DIATOMS	.00	1.86	.00	.62	1.07	.07
DIVISION TOTAL	1853.83	447.86	430.03	910.57	816.93	97.59
CHLOROPHYTA						
STIGEOCLONIUM TENUE	35.65	23.77	7.92	22.45	13.91	2.41
DIVISION TOTAL	35.65	23.77	7.92	22.45	13.91	2.41
TOTAL DENSITY	1889.48	471.62	437.95	933.02	828.49	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 2.709
VARIANCE = .0012
MAXIMUM INDEX = 3.829
EVENNESS = .707

NITZSCHIA DISSIPATA	351.31	306.79	384.72	347.60	39.09	8.80
NITZSCHIA FONTICOLA	7.64	.00	.00	2.55	4.41	.06
NITZSCHIA FRUSTULUM	168.02	328.71	384.72	293.81	112.49	7.44
NITZSCHIA PALEA	.00	43.83	17.49	20.44	22.06	.52
NITZSCHIA SP.	.00	.00	17.49	5.83	10.10	.15
RHOICOSPHENIA CURVATA	91.64	109.57	104.92	102.05	9.30	2.58
SURIRELLA OVATA	.00	.00	34.97	11.66	20.19	.30
SYNEDRA SP.	.00	21.91	.00	7.30	12.65	.18
UNIDENTIFIED PENNATE DIATOMS	.00	.00	34.97	11.66	20.19	.30
DIVISION TOTAL	2756.98	4777.18	4266.87	3933.68	1050.51	99.60
CYANOPHYTA						
LYNGBYA SP.	.00	23.77	.00	7.92	13.72	.20
EUGLENA SP.	.00	.00	23.77	7.92	13.72	.20
DIVISION TOTAL	.00	23.77	23.77	15.84	13.72	.40
TOTAL DENSITY	2756.98	4800.95	4290.63	3949.52	1063.82	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 2.416
VARIANCE = .0006
MAXIMUM INDEX = 3.784
EVENNESS = .638
NO OF SPECIES = 44

SAMPLE STATION: WPD3 - HUNTER
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 10-04-82

TAXON	DENSITY (UNITS/MM2) REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA VAR. DUBIA	36.67	4.65	5.80	15.71	18.16	1.68
ACHNANTHES MINUTISSIMA	407.44	41.81	66.29	171.84	204.39	18.42
AMPHORA OVALIS VAR. AFFINIS	.00	.93	.00	.31	.54	.03
AMPHORA PERPUSILLA	48.89	7.43	8.29	21.54	23.69	2.31
COCCONEIS PLACENTULA VAR. LINEATA	114.08	48.32	33.97	65.46	42.72	7.02
CYCLOTELLA MENEGHINIANA	.00	2.79	.00	.93	1.61	.10

NO OF SPECIES = 46

PERIPHYTON DENSITY AND SPECIES DIVERSITY ESTIMATES

CATHEDRAL BLUFFS SHALE OIL COMPANY
PICEANCE CREEK

SAMPLE STATION: WP01 - STEWART
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 11-03-82

TAXON	DENSITY (UNITS/MM2) REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA VAR. DUBIA	16.92	.00	20.30	12.41	10.88	.32
ACHNANTHES LINEARIS	.00	.00	30.45	10.15	17.58	.26
ACHNANTHES MINUTISSIMA	202.98	282.03	385.72	290.24	91.64	7.55
AMPHORA PERPUSILLA	33.83	.00	40.60	24.81	21.75	.65
AMPHORA VENETA	.00	.00	10.15	3.38	5.86	.09
COCCONEIS PEDICULUS	.00	12.26	.00	4.09	7.08	.11
COCCONEIS PLACENTULA VAR. LINEATA	16.92	24.52	30.45	23.96	6.79	.62
CYCLOTELLA MENEGHINIANA	33.83	.00	10.15	14.66	17.36	.38
CYMBELLA MINUTA VAR. SILESIACA	33.83	.00	.00	11.28	19.53	.29
CYMBELLA SINUATA	.00	12.26	.00	4.09	7.08	.11
DIATOMA TENUE VAR. ELONGATUM	16.92	.00	.00	5.64	9.77	.15
DIATOMA VULGARE	.00	12.26	10.15	7.47	6.56	.19
FRAGILAREA CONSTRUENS VAR. BINODIS	.00	.00	50.75	16.92	29.30	.44
FRAGILARIA VAUCHERIAE	.00	.00	10.15	3.38	5.86	.09
GOMPHONEMA OLIVACEUM	253.73	564.05	416.17	411.32	155.22	10.70
GOMPHONEMA PARVULUM	16.92	12.26	30.45	19.88	9.45	.52
GOMPHONEMA SUBCLAVATUM	.00	.00	20.30	6.77	11.72	.18
GOMPHONEMA TENELLUM	.00	.00	30.45	10.15	17.58	.26
HANTZSCHIA AMPHIOXYS	.00	12.26	.00	4.09	7.08	.11
NAVICULA CRYPTOCEPHALA VAR. VENETA	389.05	416.91	406.02	403.99	14.04	10.51
NAVICULA HEUFLERI	33.83	49.05	.00	27.63	25.11	.72
NAVICULA MINIMA	.00	12.26	.00	4.09	7.08	.11
NAVICULA MUTICA	.00	.00	10.15	3.38	5.86	.09
NAVICULA MUTICA VAR. UNDULATA	16.92	.00	.00	5.64	9.77	.15
NAVICULA NOTHA	84.58	98.10	182.71	121.79	53.19	3.17
NAVICULA RHYNCHOCEPHALA	.00	.00	20.30	6.77	11.72	.18
NAVICULA SALINARUM VAR. INTERMEDIA	50.75	98.10	10.15	53.00	44.02	1.38
NAVICULA SECRETA VAR. APICULATA	84.58	134.88	131.96	117.14	28.24	3.05
NAVICULA TRIPUNCTATA	16.92	24.52	20.30	20.58	3.81	.54
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	16.92	.00	.00	5.64	9.77	.15
NAVICULA VIRIDULA VAR. AVENACEA	1708.45	1226.20	1015.05	1316.57	355.42	34.26
NITZSCHIA APICULATA	16.92	12.26	.00	9.73	8.74	.25
NITZSCHIA CAPITELLATA	.00	.00	20.30	6.77	11.72	.18
NITZSCHIA COMMUNIS	.00	.00	10.15	3.38	5.86	.09
NITZSCHIA DISSIPATA	541.29	637.62	578.58	585.83	48.57	15.25
NITZSCHIA FRUSTULUM	101.49	159.41	263.91	174.94	82.32	4.55
NITZSCHIA PALEACEA	.00	.00	10.15	3.38	5.86	.09
NITZSCHIA PALEA	.00	12.26	40.60	17.62	20.82	.46
RHOICOSPHENIA CURVATA	50.75	24.52	30.45	35.24	13.75	.92
SURIRELLA OVATA	16.92	12.26	50.75	26.64	21.01	.69
DIVISION TOTAL	3755.20	3850.27	3897.80	3834.42	72.61	99.79

CYANOPHYTA						
LYNGBYA SP.	23.77	.00	.00	7.92	13.72	.21
DIVISION TOTAL	23.77	.00	.00	7.92	13.72	.21
TOTAL DENSITY	3778.97	3850.27	3897.80	3842.35	59.81	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 2.272
VARIANCE = .0005
MAXIMUM INDEX = 3.714
EVENNESS = .612
NO OF SPECIES = 41

SAMPLE STATION: WPO2 - MIDDLE
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 11-03-82

TAXON	DENSITY (UNITS/MM2) REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA VAR. DUBIA	210.46	71.59	117.28	133.11	70.77	2.77
ACHNANTHES MINUTISSIMA	441.96	272.03	254.11	322.70	103.67	6.72
AMPHORA PERPUSILLA	63.14	100.22	.00	54.45	50.67	1.13
COCCONEIS PEDICULUS	.00	14.32	.00	4.77	8.27	.10
COCCONEIS PLACENTULA VAR. EUGLYPTA	.00	.00	39.09	13.03	22.57	.27
COCCONEIS PLACENTULA VAR. LINEATA	63.14	57.27	97.73	72.71	21.87	1.51
CYCLOTELLA MENEGHINIANA	21.05	42.95	19.55	27.85	13.10	.58
CYMBELLA AFFINIS	42.09	.00	39.09	27.06	23.48	.56
CYMBELLA MINUTA VAR. SILESIACA	.00	14.32	.00	4.77	8.27	.10
CYMBELLA SINUATA	42.09	14.32	.00	18.80	21.40	.39
FRAGILARIA CONSTRUENS	21.05	.00	.00	7.02	12.15	.15
FRAGILARIA LEPTOSTAURON	.00	28.64	.00	9.55	16.53	.20
FRAGILARIA VAUCHERIAE	21.05	.00	.00	7.02	12.15	.15
GOMPHONEMA OLIVACEUM	463.00	100.22	312.75	291.99	182.28	6.08
GOMPHONEMA PARVULUM	105.23	57.27	78.19	80.23	24.04	1.67
GOMPHONEMA SUBCLAVATUM	.00	14.32	.00	4.77	8.27	.10
GOMPHONEMA TENELLUM	21.05	.00	58.64	26.56	29.71	.55
HANTZSCHIA AMPHIOXYS	.00	28.64	.00	9.55	16.53	.20
NAVICULA ARVENSIS	21.05	.00	.00	7.02	12.15	.15

NAVICULA CRYPTOCEPHALA VAR. VENETA	147.32	243.40	156.37	182.36	53.05	3.80
NAVICULA HEUFLERI	63.14	28.64	39.09	43.62	17.69	.91
NAVICULA MINIMA	42.09	.00	19.55	20.55	21.06	.43
NAVICULA NOTHA	105.23	286.35	156.37	182.65	93.38	3.80
NAVICULA SALINARUM VAR. INTERMEDIA	42.09	28.64	19.55	30.09	11.34	.63
NAVICULA SECRETA VAR. APICULATA	210.46	214.76	175.92	200.38	21.29	4.17
NAVICULA TRIPUNCTATA	21.05	.00	.00	7.02	12.15	.15
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	.00	28.64	.00	9.55	16.53	.20
NAVICULA VIRIDULA VAR. AVENACEA	2125.61	1503.34	1974.22	1867.72	324.52	38.88
NITZSCHIA APICULATA	.00	.00	19.55	6.52	11.29	.14
NITZSCHIA CAPITELLATA	.00	28.64	.00	9.55	16.53	.20
NITZSCHIA DISSIPATA	589.28	1002.23	332.29	641.27	337.98	13.35
NITZSCHIA FRUSTULUM	378.82	357.94	156.37	297.71	122.85	6.20
NITZSCHIA GRACILIS	.00	14.32	.00	4.77	8.27	.10
NITZSCHIA PALEA	.00	28.64	.00	9.55	16.53	.20
NITZSCHIA TRYBLIONELLA VAR. LEVIDENS	21.05	.00	.00	7.02	12.15	.15
NITZSCHIA SP.	.00	14.32	.00	4.77	8.27	.10
RHOICOSPHENIA CURVATA	63.14	42.95	19.55	41.88	21.81	.87
SURIRELLA OVATA	42.09	71.59	58.64	57.44	14.78	1.20
SYNEDRA ACUS	.00	.00	19.55	6.52	11.29	.14
SYNEDRA DELICATISSIMA	21.05	.00	.00	7.02	12.15	.15
SYNEDRA ULNA	21.05	.00	.00	7.02	12.15	.15
UNIDENTIFIED PENNATE DIATOMS	63.14	42.95	.00	35.36	32.25	.74
DIVISION TOTAL	5492.92	4753.42	4163.46	4803.26	666.13	100.00
TOTAL DENSITY	5492.92	4753.42	4163.46	4803.26	666.13	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 2.358
VARIANCE = .0004
MAXIMUM INDEX = 3.738
EVENNESS = .631
NO OF SPECIES = 42

SAMPLE STATION: WPO3 - HUNTER
REPLICATES - 3
SUBSTRATE - GLASS SLIDES

SAMPLE DATE - 11-03-82

	DENSITY (UNITS/MM2)					
TAXON	REP 1	REP 2	REP 3	MEAN	S.D.	% RELATIVE ABUNDANCE
BACILLARIOPHYTA						
ACHNANTHES LANCEOLATA	.00	.30	.00	.10	.17	.06

ACHNANTHES LANCEOLATA VAR. DUBIA	14.01	1.49	.00	5.17	7.70	3.33
ACHNANTHES MINUTISSIMA	17.13	8.62	.74	8.83	8.19	5.70
AMPHORA OVALIS VAR. AFFINIS	.00	.30	.00	.10	.17	.06
AMPHORA PERPUSILLA	3.11	2.67	.37	2.05	1.47	1.32
COCCONEIS PLACENTULA VAR. LINEATA	7.78	11.29	15.24	11.44	3.73	7.38
CYCLOTELLA MENEGHINIANA	1.56	.89	3.35	1.93	1.27	1.25
CYMBELLA AFFINIS	4.67	.59	.37	1.88	2.42	1.21
CYMBELLA CYMBIFORMIS	.00	.00	.37	.12	.22	.08
CYMBELLA MINUTA VAR. SILESIACA	.00	.00	.74	.25	.43	.16
CYMBELLA SINUATA	.00	.00	.37	.12	.22	.08
DIATOMA VULGARE	.00	.59	.00	.20	.34	.13
FRAGILARIA LEPTOSTAURON	.00	.00	.74	.25	.43	.16
FRAGILARIA VAUCHERIAE	4.67	1.19	1.12	2.32	2.03	1.50
GOMPHONEMA OLIVACEUM	13.23	14.56	9.67	12.49	2.53	8.06
GOMPHONEMA PARVULUM	.00	.89	1.86	.92	.93	.59
GOMPHONEMA TENELLUM	1.56	1.49	2.60	1.88	.63	1.21
NAVICULA CRYPTOCEPHALA VAR. VENETA	10.12	4.16	5.20	6.49	3.18	4.19
NAVICULA HEUFLERI	3.89	2.08	1.12	2.36	1.41	1.52
NAVICULA LANCEOLATA VAR. DUBIA	.00	.00	.74	.25	.43	.16
NAVICULA MINIMA	.78	.00	.74	.51	.44	.33
NAVICULA MUTICA	.00	1.49	.37	.62	.77	.40
NAVICULA NOTHA	7.01	4.46	4.46	5.31	1.47	3.42
NAVICULA PUPULA	.00	.00	.37	.12	.22	.08
NAVICULA SALINARUM VAR. INTERMEDIA	1.56	.00	2.23	1.26	1.14	.81
NAVICULA SECRETA VAR. APICULATA	5.45	5.35	3.35	4.71	1.19	3.04
NAVICULA TRIPUNCTATA VAR. SCHIZONEMO	.78	.00	.74	.51	.44	.33
NAVICULA VIRIDULA VAR. AVENACEA	77.84	29.71	37.92	48.49	25.75	31.29
NAVICULA SP.	.00	.59	.00	.20	.34	.13
NITZSCHIA APICULATA	2.34	1.19	.37	1.30	.99	.84
NITZSCHIA DISSIPATA	11.68	8.91	5.58	8.72	3.05	5.63
NITZSCHIA FRUSTULUM	15.57	9.51	11.15	12.08	3.13	7.79
NITZSCHIA HUNGARICA	.00	.59	1.12	.57	.56	.37
NITZSCHIA PALEA	.00	.30	.00	.10	.17	.06
NITZSCHIA SIGMOIDEA	.78	.00	.00	.26	.45	.17
PINNULARIA BREBISSONII	.00	.59	.00	.20	.34	.13
RHOICOSPHENIA CURVATA	14.01	3.86	3.35	7.07	6.01	4.56
RHOPALODIA MUSCULUS	.78	.00	.00	.26	.45	.17
STEPHANODISCUS SP.	1.56	.00	.00	.52	.90	.33
SURIRELLA OVATA	.00	.59	.74	.45	.39	.29
SYNEDRA ACUS	.78	.00	.37	.38	.39	.25
SYNEDRA AMPHICEPHALA	.78	.00	.00	.26	.45	.17
UNIDENTIFIED PENNATE DIATOMS	.00	.30	.74	.35	.37	.22
DIVISION TOTAL	223.41	118.54	118.22	153.39	60.64	98.98
CYANOPHYTA						
ANABAENA SP.	.00	.00	4.75	1.58	2.74	1.02
DIVISION TOTAL	.00	.00	4.75	1.58	2.74	1.02
TOTAL DENSITY	223.41	118.54	122.98	154.98	59.31	100.00

DIVERSITY INDEX CALCULATIONS

SHANNON INDEX = 2.658

VARIANCE = .0109
MAXIMUM INDEX = 3.784
EVENNESS = .703
NO OF SPECIES = 44

The green algae (Chlorophyta) increased in importance in mid-summer, peaked in the July 29 samples and accounted for 10 to 23% of the total mean periphyton density over all sample periods. The increased importance of green algae in the summer samples was due primarily to a growth pulse of Stigeoclonium tenue.

The mean density values for the three Piceance Creek locations are listed for each sampling date in Table 2.5.2-15. Density values ranged from 155 algal units/mm^2 (Hunter Station-November 3 sample) to 20,452 algal units/mm^2 (Middle Station-June 1 sample) and evidenced both spatial and temporal variations. The highest density for Stewart Station occurred in September while the highest densities for Middle and Hunter Station were in June. The periphyton densities at Hunter Station were reduced in the last three samples by the effects of flooding that destroyed the July 29 sample and deposited 2-4 feet of silt at the sample station. This silt persisted through the November sampling period and comprised almost 90% of the substrate (as compared to only 40% before flooding).

The dominant members of the periphton community at Stewart Station in 1982 are presented in Table 2.5.2-16 along with quantitative results from previous years. Navicula viridula var. avenacea was a dominant taxa throughout the 1982 sampling year. Achnanthes minutissima, Rhoicospheria curvata, Nitzschia dissipata, Nitzschia frustulum, Gonphonema olivaceum, were also abundant while other Nitzschia and Navicula species varied seasonally. The green algae Stigeoclonium tenue occurred as a dominant on July 29; this can be attributed to its growth preference for warmer water temperatures. The periphyton density at Stewart Station in 1982 increased from a spring minimum of 3349 units/mm^2 to a high density of 13275 units/mm^2 on September 2 and decreased again toward fall.

The dominant taxa observed at Middle Station in 1982 are presented in Table 2.5.2-17 with the quantitative results from previous sampling years. In 1982, Middle Station showed a periphyton assemblage and seasonal variation similar to that of Stewart Station. Periphyton density in spring was much higher than at Stewart Station (20,452 units/mm^2) and showed a somewhat lower summer density peak on September 2 (8507 units/mm^2).

The dominant taxa observed at Hunter in 1982 along with the quantitative results from previous sampling years are presented in Table 2.5.2-18. In spring and early summer, 1982, the periphyton assemblages at Hunter Station were similar to those at the other sampling stations. The periphyton density was high on the first two sampling periods (14,563 and 13,001 units/mm^2) with spring values similar to that at Hunter Station and early summer values higher than at the two other stations. For the summer through fall samples the periphyton community at Hunter Station was seriously effected by the late July flash flood and the accompanying scouring and silt deposition. The dominant taxa in the periphyton after the flood consisted of the early colonizers of artificial substrates such as Achnanthes species and Cocconeis species. (Cholnoky 1968). By November 3, the periphyton assemblage was similar to that found at the other stations but densities were still much lower.

TABLE 2.5.2-15

MEAN DENSITIES (units/mm^2) OF PERIPHYTON SAMPLES COLLECTED FROM PICEANCE CREEK DURING 1982

Sample Date	Stewart Station	Middle Station	Hunter Station
June 1	3349	20452	14563
June 30	7851	3190	13001
July 29	6678	2980	1/
September 2	13275	8507	1051
October 4	8707	3950	933
November 3	3731	4803	155

1/ Samples destroyed by flash flood.

TABLE 2.5.2-16

DOMINANT PERIPHYTON SPECIES (>5% mean relative abundance) OCCURRING AT STEWART STATION, FROM 1978 THROUGH 1982 (values rounded to the nearest percent)

SPECIES	MEAN RELATIVE ABUNDANCE (%) 1978	1979	1980	1981	1982
LATE MAY - EARLY JUNE					
Achnanthes minutissima	+1/	11	2/	+	12
Navicula cryptocephala var. veneta	13	- 3/		+	+
N. secreta var. apiculata	12	19		7	+
N. tripunctata var. schizomoides	6	-		-	+
N. viridula var. avenacea	+	42		60	59
N. spp.	8	+		-	-
Nitzshia dissipata	-	-		6	+
N. palea	7	-		+	-
N. spp.	27	10		-	+
Surirella angustata	+	+		-	-
S. ovata	5	+		+	+
unidentified pennate diatoms	5	-		-	+
LATE JUNE - EARLY JULY					
Achnanthes minutissima	7	13	+	10	10
Fragilaria vaucheriae	-	6	+	+	+
Gomphonema olivaceum	+	6	+	+	+
G. parvulum	+	9	-	-	-
Navicula cryptocephala var. veneta	+	-	+	5	+
N. secreta var. apiculata	9	-	7	-	+
N. viridula	-	-	44	28	-
N. viridula var. avenacea	+	28	-	-	28
Nitzschia acicularis	25	+	+	-	+
N. dissipata	+	*4/	*	+	6
N. fonticola	-	-	7	-	+
N. frustulum	-	-	-	16	+
N. palea	9	-	7	+	+
N. paleacea	-	*	*	-	5
N. spp.	42	19	-	-	+
Rhoicosphenia curvata	-	*	*	+	8
Surirella ovata	+	+	9	+	-
Synedra ulna var. oxyrhynchus	-	+	-	6	-

TABLE 2.5.2-16 (Contd)

SPECIES	MEAN RELATIVE ABUNDANCE (%) 1978	1979	1980	1981	1982
LATE JULY - EARLY AUGUST					
Achnanthes lanceolata	9	14	+	-	-
A. l. var. dubia	41	+	+	+	+
A. minutissima	35	29	6	16	+
Cocconeis placentula	-	-	+	13	-
C. placentula var. euglypta	+	34	-	-	-
C. placentula var. lineata	-	*	*	-	5
Navicula secreta var. apiculata	+	-	13	-	+
N. viridula	-	-	25	+	-
N. viridula var. avenacea	+	10	-	-	12
Nitzshia dissipata	-	-	20	6	+
N. frustulum	-	-	9	15	+
Rhoicosphenia curvata	+	-	+	9	18
palmella stage of Chaetophoraceae	-	-	-	11	-
Phormididium sp.	+	-	-	8	+
Stigeoclonium tenue	+	-	-	-	8
LATE AUGUST - EARLY SEPTEMBER					
Achnanthes lanceolata	+	14	+	-	-
A. lanceolata var. dubia	32	-	-	+	+
A. minutissima	13	57	42	+	5
Cocconeis pediculus	11	-	-	+	+
C. placentula var. euglypta	9	22	-	-	-
Gomphonema angustatum	-	-	+	6	-
Navicula cryptocephala var. veneta	+	*	*	+	8
N. secreta var. apiculata	7	-	+	6	+
N. viridula var. avenacea	+	*	*	+	22
Nitzschia dissipata	-	-	28	10	14
N. frustulum	-	-	5	16	11
N. holsatica	-	-	-	6	-
N. palea	-	-	+	7	+
Rhoicosphenia curvata	+	*	*	+	6
Draparnaldia sp.	-	-	-	13	-
LATE SEPTEMBER - EARLY OCTOBER					
Achnanthes lanceolata var. dubia	+	5/	12	14	+
A. minutissima	84		25	19	24
Cocconeis pediculus	6		+	+	-
C. placentula	-		42	39	-
Navicula viridula var. avenacea	-		*	+	26
Nitzschia dissipata	-		10	+	19
N. frustulum	-		*	+	5
palmella stage of Chaetophoraceae	-		+	15	-

TABLE 2.5.2-16 (Contd)

SPECIES	MEAN RELATIVE ABUNDANCE (%) 1978	1979	1980	1981	1982
LATE OCTOBER - EARLY NOVEMBER					
Achnanthes lanceolata	+	7	-	-	-
A. minutissima	75	79	47	+	8
Cocconeis pediculus	7	-	+	+	+
Gomphonema angustatum	-	-	-	7	-
G. olivaceum	+	+	8	+	11
Navicula cryptocephala var. veneta	+	*	*	+	11
N. secreta var. apiculata	+	+	6	+	+
N. viridula var. avenacea	+	+	11	13	34
Nitzschia dissipata	+	-	9	12	15
N. frustulum	-	-	+	7	+
N. palea	-	-	+	7	+
Rhoicosphena curvata	+	+	+	7	+

1/ + = present at <5% mean relative abundance

2/ Periphyton not sampled in May 1980

3/ - = absent

4/ * = Information not available at report time

5/ Periphyton not sampled in September 1979

TABLE 2.5.2-17

DOMINANT PERIPHYTON SPECIES (>5% mean relative abundance)
OCCURRING AT MIDDLE STATION, 1979 THROUGH 1982
(values rounded to the nearest percent)

SPECIES	MEAN RELATIVE ABUNDANCE (%) 1979	1980	1981	1982
LATE MAY - EARLY JUNE				
Achnanthes lanceolata	1/	1/	43	+2/
A. minutissima			19	9
Cocconeis placentula			5	-3/
Navicula viridula var. avenacea			+	50
Nitzschia dissipata			+	8
Chaetophoraceae sp.			19	-
LATE JUNE - EARLY JULY				
Achnanthes lanceolata	30	+	+	-
A. minutissima	9	+	-	+
Navicula secreta var. apiculata	-	8	-	+
N. viridula	-	+	24	-
N. viridula var. avenacea	23	-	-	52
Nitzschia acicularis	+	11	-	-
N. dissipata	-	+	14	+
N. frustulum	-	+	28	6
N. holsatica	-	26	+	-
N. palea	-	10	+	+
N. spp.	14	-	-	+
palmella stage of Chaetophoraceae	-	5	-	-
LATE JULY - EARLY AUGUST				
Achnanthes lanceolata	6	+	+	+
A. lanceolata var. dubia	*4/	*	+	7
A. minutissima	45	+	33	+
Gomphonema angustatum	-	+	5	-
G. parvulum	15	-	-	+
Navicula secreta var. apiculata	-	19	-	+
N. viridula	-	30	+	-
N. viridula var. avenacea	*	*	+	11
Nitzschia frustulum	-	+	21	-
N. holsatica	-	9	-	-
N. palea	-	14	+	+
N. spp.	8	-	-	+
Rhoicosphena curvata	+	+	11	14
Cladophora sp.	11	-	+	-
Stigeoclonium tenue	*	*	-	20

TABLE 2.5.2-17 (Contd)

SPECIES	1979	1980	1981	1982
	MEAN RELATIVE ABUNDANCE (%)			
LATE AUGUST - EARLY SEPTEMBER				
Achnanthes lanceolata	29	8	-	-
A. minutissima	42	48	5	+
Cocconeis placentula	-	20	+	-
C. placentula var. euglypta	21	-	-	+
Diatoma tenue var. elongatum	-	-	11	+
Fragilaria crotonensis	+	-	21	-
Navicula cryptocephala var. veneta	*	*	+	8
N. heufleri	*	*	+	7
N. viridula var. avenacea	*	*	+	31
Nitzschia dissipata	*	*	+	6
N. frustulum	*	*	+	8
Rhoicosphenia curvata	*	*	+	9
Synedra fasciculata	-	-	13	+
S. ulna var. oxyrhynchus	-	-	5	-
palmella stage of Chaetophoraceae	-	7	+	-
LATE SEPTEMBER - EARLY OCTOBER				
Achnanthes lanceolata var. dubia	5/	11	+	+
A. mintussima		59	39	9
Cocconeis placentula		12	14	-
Gomphonema angustatum		-	9	-
Navicula viridula var. avenacea		*	+	39
Nitzschia dissipata		*	+	9
N. frustulum		*	+	7
palmella stage of Chaetophoraceae		5	10	-
LATE OCTOBER - EARLY NOVEMBER				
Achnanthes lanceolata	18	+	-	-
A. mintussima	44	15	6	7
Cocconeis placentula var. euglypta	5	-	-	+
C. placentula var. lineata	7	-	-	+
Cymbella minuta var. silesiaca	-	5	+	+
Cymbella minuta var. veneta	-	5	14	-
Gomphonema olivaceum	*	*	+	6
Navicula secreta var. apiculata	7	9	+	+
N. viridula var. avenacea	5	31	16	39
Nitzschia dissipata	*	*	+	13
N. frustulum	*	*	+	6
N. spp.	5	-	+	+
Rhoicosphenia curvata	+	+	5	+
palmella stage of Chaetophoraceae	-	11	-	-

TABLE 2.5.2-17 (Contd)

1/ Periphyton not sampled in May 1979 and 1980

2/ + = present at <5% mean relative abundance

3/ - = absent

4/ * = Information not available at report time

5/ Periphyton not sampled in late September 1979

TABLE 2.5.2-18

DOMINANT PERIPHYTON SPECIES (>5% mean relative abundance)
OCCURRING AT HUNTER STATION, 1977 THROUGH 1982
(values rounded to the nearest percent)

	MEAN RELATIVE ABUNDANCE (%)					
SPECIES	1977	1978	1979	1980	1981	1982
LATE MAY - EARLY JUNE						
Achnanthes lanceolata var. dubia	+1/	+	+	2/	10	+
A. minutissima	+	6	8		51	+
Navicula secreta var. apiculata	+	11	9		+	+
N. tripunctata var. schizonemoides	-3/	15	-		-	+
N. viridula var. avenacea	65	+	57		13	51
N. spp.	+	5	+		-	-
Nitzschia palea	5	6	-		6	13
N. spp.	+	26	16		-	+
unidentified pennate diatoms	+	7	-		-	-
Stigeoclonium tenue	-	+	-		6	-
LATE JUNE - EARLY JULY						
Achnanthes lanceolata var. dubia	4/	8	6	+	+	+
A. minutissima		8	+	+	+	6
Gomphonema parvulum		+	23	-	-	+
Navicula secreta var. apiculata		+	-	5	-	+
N. viridula		-	-	58	13	-
N. viridula var. avenacea		11	48	-	-	26
Nitzschia acicularis		31	-	+	-	-
N. frustulum		-	-	-	5	32
N. holsatica		-	-	13	-	-
N. linearis		-	-	+	9	+
N. palea		11	-	11	5	+
N. spp.		17	15	-	-	-
Surirella ovalis		+	-	-	13	+
S. ovata		+	+	5	+	+
Synedra ulna		-	+	-	7	-
Thalassiosira fluviatilis		-	-	-	26	+

TABLE 2.5.2-18 (Contd)

SPECIES	MEAN RELATIVE ABUNDANCE (%) 1977	1978	1979	1980	1981	1982
LATE JULY - EARLY AUGUST						
Achnanthes lanceolata	5/	6	7	+	-	9/
A. lanceolata var. dubia		26	+	-	+	
A. minutissima		38	41	+	61	
Gomphonema parvulum		+	13	+	-	
Navicula cryptocephala		-	7	+	-	
N. secreta var. apiculata		+	-	9	-	
N. viridula		-	-	67	+	
N. viridula var. avenacea		+	8	-	-	
Nitzschia dissipata		-	-	5	6	
N. frustulum		-	-	+	7	
N. spp.		+	14	-	-	
Rhoicosphenia curvata		+	+	+	5	
Stigeoclonium sp.		9	-	-	-	
LATE AUGUST - EARLY SEPTEMBER						
Achnanthes lanceolata	6/	+	12	+	-	-
A. lanceolata var. dubia		23	-	+	+	+
A. minutissima		32	76	50	27	-
Cocconeis pediculus		12	-	+	-	-
C. placentula		-	-	5	+	-
C. placentula var. euglypta		6	7	-	-	+
C. placentula var. lineata		-	*10/	*	-	74
Cymbella minuta var. silesiaca		-	-	+	7	-
Gomphonema angustatum		-	-	+	13	-
G. olivaceum		+	*	*	+	5
Navicula viridula var. avenacea		+	+	-	9	+
Nitzschia dissipata		+	-	10	19	+
palmella stage of Chaetophoraceae		-	-	11	-	-
LATE SEPTEMBER - EARLY OCTOBER						
Achnanthes lanceolata var. dubia	7/	8/	7/	31	+	+
A. minutissima				16	37	18
Cocconeis pediculus				10	-	-
C. placentula				30	+	-
C. placentula var. lineata				*	-	7
Cymbella minuta var. silesiaca				+	10	-
Gomphonema angustatum				-	10	-
Navicula viridula var. avenacea				*	+	9
Nitzschia dissipata				+	6	11
N. frustulum				+	9	13
Rhoicosphenia curvata				*	+	9
Stigeoclonium tenue				-	7	+

TABLE 2.5.2-18 (Contd)

SPECIES	MEAN RELATIVE ABUNDANCE (%) 1977	1978	1979	1980	1981	1982
LATE OCTOBER - EARLY NOVEMBER						
Achnanthes lanceolata	-	-	49	+	+	+
A. lanceolata var. *dubia*	+	9	-	+	6	+
A. minutissima	+	+	20	5	21	6
Cocconeis pediculus	+	6	-	+	-	-
C. placentula	15	+	-	+	6	-
C. placentula var. *euglypta*	-	27	+	-	-	-
C. placentula var. *lineata*	*	-	*	*	-	7
Gomphonema angustatum	-	-	-	-	8	-
G. olivaceum	+	+	+	+	8	8
Navicula cryptocephala var. *veneta*	-	+	-	+	6	+
N. secreta var. *apiculata*	23	10	10	+	+	+
N. viridula var. *avenacea*	22	28	10	72	+	31
Nitzschia dissipata	*	-	*	*	+	6
N. frustulum	-	-	-	+	12	8
N. palea	+	-	-	-	5	+
N. spp.	12	-	-	-	-	-
Rhoicosphenia curvata	*	+	*	*	+	5
palmella stage of Chaetophoraceae	-	-	-	5	+	-

1/ + = present at <5% mean relative abundance

2/ Periphyton not sampled in May 1980

3/ - = absent

4/ Periphyton not sampled in late June - early July 1977

5/ Periphyton not sampled in late July - early August 1977

6/ Periphyton not sampled in late August - early September 1977

7/ Periphyton not sampled in late September 1977 and 1979

8/ Sampler destroyed in 1978

9/ Sampler destroyed in 1982

10/ * = Data not available at report time

Only qualitative periphyton data were obtained in 1974-1976 (C-b Annual Report of 1977). As a result, no information is available for comparison of relative abundance and dominance. Since Middle Station was initiated into the monitoring program in 1979, comparison of the three stations can only be made subsequent to 1979. The Stewart Station site was moved to its present location after the 1977 sampling season. Hence quantitative comparisons can be made for this station from 1978 to 1981, while quantitative records for Hunter Station are available from 1977-1981.

Annual variations are occurring in Piceance Creek based on comparisons of 1982 periphyton samples with previous periphyton analysis. The periphyton communities in 1977-1981 samples showed temporal variations between communities dominated by *Navicula* species and *Nitzschia* species and communities dominated by *Achnanthes* species and *Cocconeis* species. In 1982, however, *Navicula* species dominated at all stations with the exception of the flood effected Hunter Station, with *Nitzschia* species and *Achnanthes* species occurring as co-dominant with seasonal variations.

Differences in sampling techniques may have been responsible for some of the variation observed over the years. In addition, the glass slide incubation time may not have been long enough on some sampling dates or the incubation disturbed by flood or other intervention.

As a result, the flora collected on these dates may have been in the phase of accumulation rather than the more stable phase of reconstruction (Hutchinson 1975). The organisms which are flat and can attach themselves directly to the substrate are usually the first to colonize glass slides. Examples include *Achnanthes lanceolata*. *A. minutissima*, *Cocconeis pediculus*, and *C. placentula*. Stalk and tube-forming diatoms occur during the reconstruction phase; *Cymbella* species, *Gomphonema* species, and *Navicula viridula* are examples of these organisms. Also, annual differences may have been due to a combination of environmental factors such as light (turbidity), temperature, flow rate, nutrients, and pH. Any or all of these factors may vary on an annual basis regardless of man-made perturbations.

Fisher's LSD procedure (1979) was used to determine if significant differences occurred in periphyton densities at Tract C-b sampling stations between 1981 and 1982 and if differences existed among stations during each 1982 sample period. The results of this analysis of variance procedure are provided in Tables 2.5.2-19 and 2.5.2-20, respectively. In the comparison of 1981 with 1982 data, a significant difference of at least 10% was noted between all sample stations with the following exceptions: Stewart Station - June and July, Middle Station - June and August, Hunter Station - May. An evaluation of 1982 data showed a significant difference of at least 5% between all sample stations during each sample period with only one exception: there were no apparent differences in periphyton densities between Stewart and Middle Station during October.

Periphyton biomass, a measure of productivity, is summarized for 1982 samples in Table 2.5.2-21. At Stewart and Hunter Stations periphyton ash-free dry weight showed similar trends to the

TABLE 2.5.2-19

COMPARISON OF 1981 AND 1982 PERIPHYTON DENSITIES AT EACH SAMPLING STATION DURING EACH SAMPLING PERIOD USING FISHER'S LSD PROCEDURE (1949)1/

Month	Stewart	Middle	Hunter
May	1%	1%	-
June	-	-	5%
July	-	1%	No data - 1982
August	1%	-	1%
September	10%	1%	1%
October	1%	1%	1%

1/ - = No significant difference between year
10% = Difference significant at the 10% level
5% = Difference significant at the 5% level
2% = Difference significant at the 2% level
1% = Difference significant at the 1% level

TABLE 2.5.2-20

COMPARISON OF PERIPHYTON DENSITIES BETWEEN EACH SAMPLING STATION DURING 1982 USING FISHER'S LSD PROCEDURE (1949)1/

Sample Station	May	June	July	August	September	October
Stewart-Middle	1%	1%	2%	1%	1%	-
Stewart-Hunter	1%	1%	2/	1%	1%	2%
Middle-Hunter	1%	1%	2/	1%	1%	1%
Stewart and Middle-Hunter	5%	1%	2/	1%	1%	1%

1/ - = No significant difference between year
10% = Difference significant at the 10% level
5% = Difference significant at the 5% level
2% = Difference significant at the 2% level
1% = Difference significant at the 1% level

2/ Data missing for Hunter Station - July 1982

TABLE 2.5.2-21

MEAN PERIPHYTON BIOMASS (mg ash-free dry weight/cm^2) FROM PICEANCE CREEK, JUNE THROUGH NOVEMBER 1982, TRACT C-b

Sample Date	Stewart Station	Middle Station	Hunter Station
June 1	1.104	1.940	1.500
June 30	1.523	1.281	1.871
July 29	1.678	1.019	1/
September 2	1.473	1.416	0.132
October 4	0.835	1.024	0.213
November 3	0.596	0.650	0.038

1/ Samples destroyed by flash flood

periphyton densities observed at these stations. In general, biomass increased to an early or late summer high and decreased in the fall. Hunter Station has ash-free dry weight values similar to those for Stewart and Middle Stations for the first two sampling periods and much lower values for the samples collected after the late summer flood. In 1975, 1976, 1977, 1979, and 1980, biomass was usually higher at Stewart Station than at Hunter Station, but was higher at the latter station in 1978, 1981, and 1982 (only the first two sample periods are used for comparison). In 1979, biomass productivity at Middle Station was generally higher than at Hunter Station, while Stewart and Middle Stations alternated positions throughout the year. In 1980, biomass productivity at Middle Station tended to be higher than at the other two stations. However, the 1981 and 1982 biomass at Middle Station was generally higher than Stewart Station but lower than Hunter Station, except after the flood at Hunter Station.

A statistical comparison of 1981 with 1982 periphyton biomass data using Fisher's LSD procedure is provided in Table 2.5.2-22; a comparison of periphyton biomass between each sampling station during 1982 is provided in Table 2.5.2-23. Periphyton biomass was generally higher at all stations during 1982 than during 1981; the exceptions are August and October samples at Hunter Station. In all comparisons except Stewart Station for July and September and Middle Station for May, the difference between the two years was significant at at least the 2% level. The comparison of biomass at different stations between 1982 showed that Stewart and Middle Station were most similar while significant differences occurred between Stewart and Hunter and between Middle and Hunter Station over almost all samples.

Diversity values estimated for each sample location during each 1982 sample period are presented in Table 2.5.2-24. Diversity values are a relative measure of environmental stress on a community; they generally decrease with increased stress. Diversities for 1982 ranged from 1.26 at Hunter Station in September, following the floods, to 3.09 at Stewart Station in July. At Stewart and Middle Station the highest diversity occurred in July while at Hunter Station the highest diversity occurred in October. Because the number of taxa found in a sample can effect the range of possible diversity values, the evenness values, E, are better for comparing samples with varying numbers of species counted. Evenness at Stewart and Middle Stations were similar throughout the 1982 sampling season with the highest values occurring in July. At Hunter Station evenness values were similar to the other stations except immediately following the July flood when it was lower.

Diversity values in previous sample years were similar to those found in 1982, though peak diversities occurred at different times. In 1981, diversities at Stewart, Middle and Hunter Stations were highest during fall. In 1980, diversities at Stewart and Middle Stations were highest during summer but were highest in early fall at Hunter Station. In 1979, highest values occurred during summer months, while the lowest occurred in fall. Diversity values in 1978 decreased steadily at Stewart and Hunter Stations between May and July but increased in August. Lowest values for both stations occurred in fall. The low density values recorded in 1978, 1979, 1980, and 1981 occurred mainly when Achnanthes species and Cocconeis

TABLE 2.5.2-22

COMPARISON OF 1981 AND 1982 PERIPHYTON BIOMASS AT EACH SAMPLING PERIOD DURING EACH SAMPLING PERIOD USING FISHER'S LSD PROCEDURES (1949)1/

Month	Stewart	Middle	Hunter
May	1%	-	1%
June	1%	1%	1%
July	-	1%	2/
August	1%	1%	1%
September	-	1%	1%
October	2%	1%	1%

1/ - = No significant difference between year
10% = Difference significant at the 10% level
5% = Difference significant at the 5% level
2% = Difference significant at the 2% level
1% = Difference significant at the 1% level

2/ Data missing for Hunter Station - July 1982

TABLE 2.5.2-23

COMPARISON OF PERIPHYTON BIOMASS BETWEEN EACH SAMPLE STATION DURING 1982 USING FISHER'S LSD PROCEDURE (1949)1/

Sample Station	May	June	July	August	September	October
Stewart-Middle	2%	-	5%	-	-	-
Stewart-Hunter	2%	-	2/	1%	1%	2%
Middle-Hunter	-	10%	2/	1%	5%	10%
Stewart and Middle-Hunter	-	10%	2/	1%	1%	5%

1/ - = No significant difference between year
10% = Difference significant at the 10% level
5% = Difference significant at the 5% level
2% = Difference significant at the 2% level
1% = Difference significant at the 1% level

2/ Data missing for Hunter Station - July 1982

TABLE 2.5.2-24

SHANNON-WEINER DIVERSITY (H'), MAXIMUM DIVERSITY (H'max), EVENNESS (E), AND TOTAL NUMBER OF TAXA (N) IN PERIPHYTON COLLECTED FROM PICEANCE CREEK, JUNE THROUGH NOVEMBER 1982, TRACT C-b

	Stewart Station				Middle Station				Hunter Station			
Sample Date	H'	H'max	E	N	H'	H'max	E	N	H'	H'max	E	N
June 1	1.85	3.66	0.51	39	2.17	3.69	0.59	40	2.07	3.58	0.58	36
June 30	2.78	3.64	0.76	38	2.28	3.89	0.59	49	2.36	3.69	0.64	40
July 29	3.09	4.01	0.77	55	2.95	3.89	0.76	49	1/	1/	1/	1/
September 2	2.77	3.85	0.72	47	2.69	3.87	0.70	48	1.26	3.22	0.39	25
October 4	2.17	3.30	0.66	27	2.42	3.78	0.64	44	2.71	3.83	0.71	46
November 3	2.27	3.71	0.61	41	2.36	3.74	0.63	42	2.66	3.78	0.70	44

1/ Samples destroyed by flash flood

species dominated the periphyton. These genera are early colonizers of glass slides; species diversity values are usually low during the earliest stage of colonization (Hutchinson 1975).

A multitude of factors such as flood, irrigation, cattle grazing, springs, and Tract C-b discharge may affect Piceance Creek aquatic systems. Since Hunter Station was so severly impacted in late July by flood, scour, and siltation, valid comparisons of periphyton composition and density are limited with respect to monitoring water quality effects of Tract C-b discharge. The periphyton diversity values for Hunter Station after the initial recovery from the floods may be useful, however, in evaluating water quality and possible Tract C-b discharge impacts. Discharge from Tract C-b development activities only affects Hunter Station; based on 1982 data before flooding occurred in late July no discernible impact to the Piceance Creek aquatic system can be attributed to Tract C-b. Any variations observed from the early baseline studies through the 1982 study seem to be attributable to agricultural impacts and natural variations.

TERRESTRIAL VEGETATION
STUDIES

2.5.3 Terrestial Vegetation Studies

The 1982 vegetation studies were conducted in accordance with the Approved Interim Monitoring Program for the C.B. Project. The Terrestial Vegetation Studies in 1982 consisted of sampling the community structure and composition of the Irrigation Study Plot, sampling for herbaceous production and utilization (range cages and adjacent open areas) in the chained pinyon-juniper rangeland and irrigated chained pinyon-juniper rangeland, (see Figure 2.5-1 for locations of range cages and adjacent open areas), and sampling for herbaceous biomass in the irrigation/fertilization study plots. Tables 2.5.3-1 to -10 show the results of these studies.

The results of the community structure and composition sampling of the Irrigation Study Plot show a decrease in herbaceous cover in 1982, along with some minor differences in species frequency. These differences could be the result of two possible reasons: 1) Heavy utilization in the area in 1982 - the vegetation in the area was more productive because of the irrigation in 1980 and 1981 and thus attracted more cattle, and cattle remained in the area throughout the 1982 growing season; 2) Differences related to data collection - in visual evaluation of species cover it is difficult to be consistent from year to year and even from quadrat to quadrat. The major differences in the results of the shrub sampling can be attributed to the analysis of 16 line-strip transects in 1982 rather than 20 transects analyzed in 1980 and 1981.

Fifteen pairs of range cages and adjacent open areas were sampled in each of the previously mentioned vegetation types. The 1982 data showed slight reductions in both production and utilization for both areas in 1982. The amount of utilization for both areas was significant. Both production and the amount of utilization of the irrigation area were significantly greater than that for the chained pinyon-juniper rangeland.

Any possible effects which irrigation and/or fertilization from previous years might have had on herbaceous biomass in the irrigation/fertilization study plots were completely masked by the heavy cattle utilization throughout the summer of 1982. The amount of herbaceous biomass in all plots was very low and no differences among the plots could be ascertained from the data.

Table 2.5.3-1 Herb quadrat summaries for the Irrigation Study Plot. Based on data from 25 permanently located quadrats. June 1982. Values in percent. "?" indicates uncertain identification. ± values are equal to the standard error of the mean.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values	Frequency (%)
HERBACEOUS SPECIES				
Agoseris glauca	<0.1	0.19	0 - <1	20
Agropyron desertorum	0.1	0.81	0 - 1	12
Agropyron smithii	2.2	21.29	0 - 8	68
Agropyron trachycaulum	0.4	4.31	0 - 4	28
Antennaria rosea	0.5	4.62	0 - 3	32
Aster fendleri	0.2	2.23	0 - 1	52
Astragalus ceramicus	<0.1	0.42	0 - 1	8
Bouteloua gracilis	<0.1	<0.01	0 - <1	4
Bromus tectorum	1.4	13.79	0 - 4	92
Chanactis donglasii	<0.1	0.12	0 - <1	12
Crepis accuminata	<0.1	0.42	0 - 1	8
Cryptantha spp.	<0.1	0.15	0 - <1	16
Erigeron pumilus	<0.1	<0.01	0 - <1	4
Heterotheca villosa	0.3	2.58	0 - 2	44
Koelaria gracilis	0.5	4.39	0 - 2	48
Lappula redowskii	<0.1	<0.01	0 - <1	4
Oryzopsis hymenoides	0.9	8.70	0 - 6	60
Penstemon caespitosus	0.3	2.43	0 - 3	28
Penstemon fremontii	<0.1	<0.01	0 - <1	4
Phlox hoodii	0.3	3.20	0 - 3	32
Phlox longifolia	0.1	0.54	0 - 1	20
Physaria floriburda	<0.1	0.12	0 - <1	12
Poa spp. (fendleriana?)	0.6	6.24	0 - 6	32
Senecio spp.	0.1	0.85	0 - 1	16
Sitanion longifolium	0.5	4.35	0 - 3	48
Sphaeralcea coccinea	0.6	5.78	0 - 5	16
Stipa comata	0.4	4.00	0 - 5	36
Taraxacum officinale	0.2	1.62	0 - 3	16
Tragapogon dubius	0.1	0.85	0 - 2	12
Sub - Total	9.7			

Table 2.5.3-1 Herb quadrat summaries for the Irrigation Study Plot. (Continued)

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values	Frequency (%)
<u>WOODY SPECIES</u>				
Artemisia tridentata	0.3	3.04	0 - 3	52
Chrysothamnus nauseosus	<0.1	0.31	0 -<1	32
Chrysothamnus viscidiflorus	<0.1	0.42	0 - 1	8
Gutierrezia sarothrae	0.2	2.08	0 - 4	24
Sub - Total	0.5			
Total Herb Cover	8.8		2 - 16	
Total Woody in Herb Layer	0.6		0 - 4	
Total Shrub Layer Cover	10.4		0 - 45	
Mosses	<0.1		0 - 1	
Lichens	0.2		0 - 2	
Litter	68.7		8 - 98	
Bare soil	20.8		0 - 60	
Rock	3.1		0 - 28	

	Mean $\pm$ S.E.	Range
No. of Herb Species/m^2	8.12 $\pm$ 0.61	1 - 14
Total No. Species/m^2	9.28 $\pm$ 0.67	1 - 15

Table 2.5.3-2 Mean cover, relative cover, frequency, and density for shrub species in the Irrigation intensive study plot. 1982 data. Height Class I = 0.25m-0.75m; Class II = 0.76-1.50m; Class III = 1.51-2.25m; Class IV = >2.25m. Values based on data from 16 10m x 4m line strip transects.

Species	Height Class	Mean Cover (%)	Relative Cover (%)	Frequency (%)	Density (No. of Individuals/ha)	
Artemisia tridentata	Total	3.13	36.0	100		1876
	I				1219	
	II				641	
	III				16	
Chrysothamnus nauseosus	Total	<0.01	<0.01	31		79
	I				63	
	II				16	
Chrysothamnus viscidiflorus	Total	0.17	2.0	69		547
	I				531	
	II				16	
Juniperus osteosperma	Total	2.25	25.9	69		360
	I				47	
	II				172	
	III				125	
	IV				16	
Juniperus scopulorum	Total	0.85	9.8	31		110
	I				63	
	II				31	
	III				16	
Opuntia polyacantha	Total	<0.01	<0.01	25		156
	I				156	

Table 2.5.3-2 Mean cover, relative cover, frequency, and density for shrub species in the Irrigation intensive study plot. 1982 data. Height Class I = 0.25m-0.75m; Class II = 0.76-1.50m; Class III = 1.51-2.25m; Class IV = >2.25m. Values based on data from 16 10m x 4m line strip transects.

Species	Height Class	Mean Cover (%)	Relative Cover (%)	Frequency (%)	Density (No. of Individuals/ha)	
Pinus edulis	Total	0.67	7.7	69		297
	I				109	
	II				109	
	III				63	
	IV				16	
Purshia tridentata	Total	0.63	7.3	13		172
	I				125	
	II				47	
Ribes spp	Total	0.15	1.7	6		31
	II				31	
Symphoricarpus oreophilus	Total	0.83	9.6	31		422
	I				313	
	II				109	

Table 2.5.3-3 Oven dry weights (grams/m^2) for range cages and adjacent open areas in the chained pinyon-juniper rangeland community type. 1982

	Quadrat Number	*Agropyron smithii*	*Bromus tectorum*	*Oryzopsis hymenoides*	Perennial Grasses	Perennial Forbs	Annual Forbs	Half Shrubs	Total Biomass
FENCED	61	0.29	1.08	0.83	10.01	2.42	-	-	14.63
	62	-	0.85	22.42	1.47	39.85	-	-	64.59
	63	26.22	4.93	0.44	0.17	0.06	0.13	-	31.95
	64	14.41	-	-	19.22	9.29	-	-	42.92
	65	10.93	-	2.26	41.84	0.04	-	-	55.07
	66	28.62	-	-	6.58	11.93	-	-	47.13
	67	30.66	1.24	3.28	-	0.20	-	-	35.38
	68	11.95	0.18	-	4.39	24.44	-	-	40.96
	69	0.55	0.06	-	1.52	82.60	5.66	-	90.39
	70	24.55	0.02	-	2.61	26.32	-	-	53.50
	71	9.02	-	7.88	0.98	5.45	-	-	23.33
	72	-	0.11	1.34	21.63	2.53	-	-	25.61
	73	-	0.63	10.74	5.33	0.34	-	-	17.04
	74	14.59	7.59	-	3.89	8.78	-	-	34.85
	75	-	13.14	1.52	19.66	13.28	0.02	-	47.62
OPEN	61	0.82	0.96	-	11.31	10.14	0.02	-	23.25
	62	-	2.80	5.83	1.73	1.00	-	21.84	33.20
	63	13.03	0.24	0.02	1.78	1.33	-	-	16.40
	64	4.61	-	-	6.95	4.02	-	-	15.58
	65	2.92	-	-	7.67	-	0.03	-	10.62
	66	9.62	-	-	9.58	13.24	0.24	-	32.68
	67	-	0.05	2.06	19.17	1.34	-	-	22.62
	68	4.70	0.04	-	6.83	12.71	-	-	24.28
	69	0.31	0.25	-	3.49	45.46	-	-	49.51
	70	0.84	0.07	0.16	8.29	2.34	0.06	-	11.76
	71	0.84	-	-	7.02	7.53	-	-	15.39
	72	1.58	7.78	-	0.41	4.29	-	-	14.06
	73	-	1.68	6.35	5.09	3.13	-	-	16.25
	74	15.95	1.76	-	2.20	5.93	-	-	25.84
	75	1.91	1.00	0.83	13.89	25.70	-	-	43.33

Table 2.5.3-4 Oven dry weights (grams/m^2) for range cage and adjacent open areas in the irrigated chained rangeland community type.

	Quadrat Number	*Agropyron smithii*	*Bromus tectorum*	*Oryzopsis hymenoides*	Perennial Grasses	Perennial Forbs	Annual Forbs	Half Shrubs	Total Biomass			
FENCED	1	7.77	1.04	25.79	47.14	1.19	-	-	82.93			
	2	-	0.18	4.36	56.81	2.87	-	-	64.22			
	3	19.44	-	-	63.17	0.34	-	-	83.45			
	4	9.18	-	-	48.89	5.97	-	-	64.04			
	5	2.73	-	-	50.28	9.66	-	-	62.67			
	6	1.87	0.04	20.12	33.49	1.40	-	-	56.92			
	7	31.04	26.31	60.19	37.27	1.48	-	-	156.29			
	8	109.68	-	-	18.12	24.18	-	-	151.98			
	9	-	-	-	53.39	1.37	-	-	54.76			
	10	19.29	-	-	14.25	5.13	-	-	38.67			
	11	54.33	0.52	6.47	5.84	11.44	-	-	78.60			
	12	-	25.13	39.39	11.29	10.96	1.80	-	88.57			
	13	40.90	1.16	-	18.28	0.71	-	-	61.05			
	14	29.97	0.23	-	9.95	7.09	0.02	-	47.26			
	15	41.00	-	-	10.46	11.58	-	-	63.04			
OPEN	1	2.37	0.09	3.44	17.91	0.41	0.04	-	24.26			
	2	-	0.03	0.06	8.89	13.05	0.02	0.43	22.48			
	3	1.65	-	-	17.97	0.23	-	-	19.85			
	4	4.60	-	-	13.86	13.94	-	0.71	33.11			
	5	12.92	-	0.13	12.31	6.54	-	-	31.90			
	6	6.19	0.45	6.76	6.32	3.28	-	-	23.00			
	7	38.44	0.03	4.67	-	0.67	-	-	43.81			
	8	28.33	-	-	14.63	17.21	0.09	-	60.26			
	9	0.89	-	-	9.84	1.38	-	-	12.11			
	10	0.20	0.02	-	14.77	8.60	-	2.04	25.63			
	11	8.21	0.97	6.29	-	6.45	-	-	21.92			
	12	-	9.58	6.11	0.28	14.63	1.33	-	31.93			
	13	7.41	1.12	0.11	11.37	2.31	-	-	22.32			
	14	10.59	-	-	5.09	21.43	-	-	37.11			
	15	14.38	-	-	14.61	2.69	-	-	31.68			

Table 2.5.3-5 Mean production (grams/m^2) $\pm$ the standard error of the mean (S.E.), frequency, and range of observed values for clipped plots in the chained pinyon-juniper rangeland. 1982 Data.

Species	Mean $\pm$ S.E.	Sample Size	Frepuency (%)	Range of Values
OPEN AREAS				
Agropyron smithii	3.81 $\pm$ 1.31	15	80	0-15.95
Bromus tectorum	1.11 $\pm$ 0.53	15	73	0- 7.78
Oryzopsis hymenoides	1.02 $\pm$ 0.55	15	40	0- 6.35
Perennial grasses	7.03 $\pm$ 1.31	15	100	0.41-19.17
Perennial forbs	9.21 $\pm$ 3.12	15	93	0-45.46
Annual forbs	0.02 $\pm$ 0.016	15	27	0- 0.24
Half shrubs	1.46 $\pm$ 1.46	15	7	0-21.84
Total Biomass	23.65 $\pm$ 2.99	15		10.62-49.51
FENCED PLOTS				
Agropyron smithii	11.45 $\pm$ 2.97	15	73	0-30.66
Bromus tectorum	1.99 $\pm$ 0.97	15	73	0-13.14
Oryzopsis hymenoides	3.38 $\pm$ 1.59	15	60	0-22.42
Perennial grasses	9.29 $\pm$ 3.01	15	93	0-41.84
Perennial forbs	15.17 $\pm$ 5.68	15	100	0.06-82.60
Annual forbs	0.39 $\pm$ 0.38	15	20	0- 5.66
Total Biomass	41.66 $\pm$ 5.07	15		14.63-90.39

Table 2.5.3-6 Mean production (grams/m^2) $\pm$ the standard error of the mean (S.E.), frequency, and range of observed values for clipped plots in the Irrigated Area. 1982 Data.

Species	Mean $\pm$ S.E.	Sample Size	Frequency (%)	Range of Values
OPEN AREAS				
Agropyron smithii	9.08 $\pm$ 2.86	15	87	0-38.44
Bromus tectorum	0.82 $\pm$ 0.63	15	53	0- 9.58
Oryzopsis hymenoides	1.84 $\pm$ 0.71	15	53	0- 6.76
Perennial grasses	9.86 $\pm$ 1.61	15	87	0-17.97
Perennial forbs	7.52 $\pm$ 1.79	15	100	0.23-21.43
Annual forbs	0.10 $\pm$ 0.09	15	27	0- 1.33
Half shrubs	0.21 $\pm$ 0.14	15	20	0- 2.04
Total Biomass	29.42 $\pm$ 2.99	15		12.11-60.26
FENCED PLOTS				
Agropyron smithii	24.51 $\pm$ 7.59	15	80	0-109.68
Bromus tectorum	3.64 $\pm$ 2.32	15	53	0- 26.31
Oryzopsis hymenoides	10.42 $\pm$ 4.72	15	40	0- 60.19
Perennial grasses	31.91 $\pm$ 5.20	15	100	5.84- 63.17
Perennial forbs	6.36 $\pm$ 1.67	15	100	0.34- 24.18
Annual forbs	0.12 $\pm$ 0.12	15	13	0- 1.80
Total Biomass	76.96 $\pm$ 8.83	15		38.67-156.29

Table 2.5.3-7 Fresh weight estimates (grams/0.10 meter) for irrigation/fertilizer study plots. 1982 Data.

Treatment Number	1a														
Fertilizer Level (Lbs/Acre) N,P	0,0														
Year Fertilizer Applied	None Applied														
Sprinkler Time Set	18 hrs														
Quadrat Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Agropyron smithii	4	-	-	-	-	2	<1	-	-	-	5	-	-	-	-
Bromus tectorum	-	1	-	<1	-	<1	<1	<1	-	-	-	-	<1	-	<1
Oryzopsis hymenoides	<1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Perennial grasses	2	2	1	<1	2	<1	3	2	4	3	-	3	<1	1	1
Perennial forbs	<1	<1	2	2	-	1	1	2	<1	-	1	2	2	1	1
Annual forbs	-	<1	2	-	-	1	-	<1	-	-	-	<1	<1	-	-
Half shurbs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTALS	6	3	5	2	2	4	4	4	4	3	6	5	3	5	2

Treatment Number	1b														
Fertilizer Level (Lbs/Acre) N,P	0,0														
Year Fertilizer Applied	None Applied														
Sprinkler Time Set	12 hrs.														
Quadrat Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Agropyron smithii	-	-	1	4	3	1	-	-	-	1	-	2	1	1	-
Bromus tectorum	<1	<1	-	-	-	-	<1	<1	<1	<1	-	-	-	-	<1
Oryzopsis hymenoides	-	-	-	1	-	-	2	-	<1	-	-	-	-	-	-
Perennial grasses	4	2	3	<1	1	1	-	-	1	2	3	-	1	1	1
Perennial forbs	2	<1	4	<1	1	2	9	6	-	2	1	<1	-	-	4
Annual forbs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Half shurbs	-	-	-	-	-	-	-	-	-	-	-	1	-	<1	-
TOTALS	6	2	8	5	5	4	11	6	1	5	4	3	2	2	5

Table 2.5.3-7 Fresh weight estimates (grams/0.10 m^2) for irrigation/fertilizer study plots. 1982 Data.

Treatment Number	3a														
Fertilizer Level (lbs/Acre) N,P	100,100														
Year Fertilizer Applied	1980 only														
Sprinkler Time Set	18 hrs.														
Quadrat Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Agropyron smithii	3	2	4	3	2	5	6	2	7	6	2	4	1	2	6
Bromus tectorum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oryzopsis hymenoides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perennial grasses	2	1	<1	-	-	<1	<1	3	<1	1	-	<1	2	1	1
Perennial forbs	2	<1	5	<1	-	<1	-	-	-	1	<1	<1	-	<1	2
Annual forbs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Half shrubs	-	-	-	-	3	-	-	-	-	-	-	1	-	-	-
TOTALS	7	3	9	3	5	5	6	5	7	8	2	5	3	2	9

Treatment Number	3a														
Fertilizer Level (lbs/Acre) N,P	100,100														
Year Fertilizer Applied	1980 & 1981														
Sprinkler Time Set	18 hrs.														
Quadrat Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Agropyron smithii	-	4	1	5	1	2	3	2	3	1	1	5	2	<1	2
Bromus tectorum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oryzopsis hymenoides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perennial grasses	1	1	<1	-	2	<1	3	3	3	3	2	<1	3	2	4
Perennial forbs	-	-	<1	-	-	-	-	-	<1	-	-	-	1	-	-
Annual forbs	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Half shrubs	-	<1	-	1	<1	-	-	-	-	-	-	<1	-	-	<1
TOTALS	1	5	1	6	2	2	6	5	6	4	3	5	5	2	6

Table 2.5.3-7 Fresh weight estimates (grams/0.10 m^2) for irrigation/firtilizer study plots. 1982 Data.

Treatment Number	3b														
Fertilizer Level (Lbs/Acre) N,P	100,100														
Year Fertilizer Applied	1980 only														
Sprinkler Time Set	12 hrs.														
Quadrat Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Agropyron smithii	-	-	-	-	2	-	3	-	3	1	2	-	-	<1	-
Bromus tectorum	<1	1	<1	<1	<1	-	-	<1	-	-	-	-	-	-	-
Oryzopsis hymenoides	-	2	-	-	-	1	-	2	-	1	-	-	-	<1	-
Perennial grasses	3	<1	2	4	1	4	1	-	-	-	-	4	3	-	2
Perennial forbs	<1	-	-	-	<1	3	1	2	-	3	2	<1	1	2	2
Annual forbs	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Half shrubs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTALS	3	3	2	4	3	8	5	4	3	5	4	4	4	2	4

Treatment Number	3b														
Fertilizer Level (Lbs/Acre) N,P	100,100														
Year Fertilizer Applied	1980 & 1981														
Sprinkler Time Set	12 hrs.														
Quadrat Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Agropyron smithii	-	2	-	3	-	3	-	-	-	-	-	4	3	2	-
Bromus tectorum	1	-	-	-	-	-	<1	-	-	-	<1	-	-	<1	<1
Oryzopsis hymenoides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
Perennial grasses	1	4	1	<1	1	<1	2	<1	7	4	2	2	1	2	1
Perennial forbs	<1	-	6	2	-	<1	2	2	-	1	-	1	1	<1	1
Annual forbs	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-
Half shrubs	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTALS	3	7	7	5	1	3	4	2	7	5	2	7	5	4	5

Table 2.5.3-7 Fresh weight estimates (grams/0.10 m^2) for irrigation/fertilizer study plots. 1982 Data. added in 1980 only.

Treatment Number	4a															4a														
Fertilizer Level (Lbs/Acre) N,P	200,100															200,100														
Year Fertilizer Applied	1980 only															1980 &1981														
Sprinkler Time Set	18 hrs.															18 hrs.														
Quadrat Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Agropyron smithii	4	2	1	2	<1	1	1	2	3	4	1	<1	<1	<1	2	2	-	-	1	1	-	2	3	2	<1	<1	2	1	<1	<1
Bromus tectorum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oryzopsis hymenoides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perennial grasses	1	<1	2	<1	2	1	3	1	2	-	3	4	2	2	3	4	3	4	3	4	5	4	2	2	3	3	2	3	4	2
Perennial forbs	<1	2	-	<1	1	<1	1	-	-	1	-	<1	1	2	-	-	1	2	-	2	-	-	-	-	-	-	1	1	-	-
Annual forbs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Half shrubs	-	-	2	-	1	-	1	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
TOTALS	5	4	5	2	4	2	6	6	5	5	4	4	3	4	5	6	4	6	4	7	5	6	5	5	3	3	4	5	4	2

Table 2.5.3-7 Fresh weight estimates (grams/0.10 m^2) for irrigation/fertilizer study plots, 1982 Data.

Treatment Number	4b														
Fertilizer Level (Lbs/Acre) N,P	200,100														
Year Fertilizer Applied	1980 only														
Sprinkler Time Set	12 hrs.														
Quadrat Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Agropyron smithii	2	1	3	-	3	1	3	-	-	6	2	<1	-	4	2
Bromus tectorum	-	<1	<1	<1	-	-	-	-	1	-	-	-	<1	-	<1
Oryzopsis hymenoides	-	-	-	2	-	-	-	-	1	-	-	-	3	-	-
Perennial grasses	2	2	1	-	-	1	1	<1	1	1	-	4	1	<1	2
Perennial forbs	1	-	-	1	-	2	1	<1	2	1	2	-	1	-	1
Annual forbs	-	<1	-	<1	-	-	-	-	-	-	-	-	-	<1	-
Half shrubs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTALS	5	3	4	3	3	4	5	-	5	8	4	4	5	4	4

Treatment Number	4b														
Fertilizer Level (Lbs/Acre) N,P	200,100														
Year Fertilizer Applied	1980 & 1981														
Sprinkler Time Set	12 hrs.														
Quadrat Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Agropyron smithii	1	1	2	1	3	4	-	1	-	3	-	2	2	1	4
Bromus tectorum	-	-	<1	<1	1	1	<1	<1	1	-	<1	-	-	1	-
Oryzopsis hymenoides	-	-	-	1	-	-	-	1	1	-	<1	-	-	-	-
Perennial grasses	<1	3	1	<1	-	-	1	1	1	<1	<1	-	1	<1	<1
Perennial forbs	<1	<1	<1	<1	-	-	-	<1	2	-	5	3	<1	-	-
Annual forbs	2	-	1	-	<1	-	<1	-	-	<1	-	-	<1	-	<1
Half shrubs	-	-	-	-	-	-	-	4	-	-	-	-	-	-	1
TOTALS	3	4	4	2	4	5	1	7	5	3	5	5	3	2	5

Table 2.5.3-8 Oven dry weights (grams/0.10m^2) for herbaceous biomass in fertilizer and irrigation treatments for irrigation study plots. 1982 Data.

Treatment Number	Quadrat Number	*Agropyron smithii*	*Bromus tectorum*	*Oryzopsis hymenoides*	Perennial Grasses	Perennial Forbs	Annual Forbs	Half Shrubs	Total Biomass		
1a	1	1.10	-	0.05	0.41	0.02	-	-	1.58		
1a	6	0.64	0.04	-	0.29	0.22	0.26	-	1.45		
1a	13	-	0.03	0.64	0.39	0.63	0.02	-	1.71		
1b	1	-	0.02	-	3.33	0.54	-	-	3.89		
1b	7	-	0.32	1.26	-	5.46	-	-	7.04		
3a '80	1	2.33	-	-	1.68	1.00	-	-	5.01		
3a '80	9	3.34	-	-	0.06	-	-	-	3.40		
3a '80&'81	1	-	-	-	0.48	-	0.02	-	0.50		
3a 80&'81	4	3.60	-	-	-	-	-	0.31	3.91		
3b 80	1	-	0.36	-	1.84	0.02	0.02	-	2.24		
3b 80	6	-	-	0.63	2.40	1.91	-	-	4.94		
3b 80 & 81	1	-	0.39	-	0.69	0.02	-	0.45	1.55		
3b 80 &81	6	1.50	-	-	0.04	0.04	-	-	1.58		
4a 80	1	1.84	-	-	0.67	0.10	-	-	2.61		
4a 80	8	0.83	-	-	0.62	-	-	2.35	3.80		
4a 80 & 81	1	0.32	-	-	2.39	-	-	-	2.71		
4a 80 & 81	9	0.89	-	-	0.54	-	-	0.19	1.62		
4b 80 & 81	2	0.59	-	-	1.04	0.05	-	-	1.68		
4b 80 & 81	8	0.40	0.17	0.38	0.44	0.02	-	1.99	3.40		

Table 2.5.3-9 Regression Equations for converting fresh weight estimates to oven dry weights in the irrigation/fertilization study plots. 1982 Data.

Species/ Species Group	Regression Equations	Correlation Coefficient
<u>Agropyron smithii</u>	y = 0.47 x - 0.07	0.93
<u>Bromus tectorum</u>	y = 0.26 x + 0.13	0.53
<u>Oryzopsis hymenoides</u>	y = 0.64 x - 0.06	0.97
Perennial grasses	y = 0.60 x - 0.02	0.89
Perennial forbs	y = 0.60 x - 0.14	0.98
Annual forbs	y = 0.27 x - 0.01	1.00
Half shrubs	y = 0.71 x - 0.25	0.89

Table 2.5.3-10 Mean production ± the standard error of the mean (S.E.), frequency, and range of observed values for quadrats in the irrigation/fertilization study plots 1a, 1b, 3a, 3b, 4a, and 4b. Based on data derived from regression equations. Production values in grams/0.10m^2.

Species/ Species Group	Mean ± S.E.	Sample Size	Frequency (%)	Range of Values
UNFERTILIZED				
Site 1a				
Agropyron smithii	0.42 ± 0.20	15	33	0-2.26
Bromus tectorum	0.09 ± 0.03	15	47	0-0.39
Oryzopsis hymenoides	0.04 ± 0.04	15	13	0-0.58
Perennial grasses	0.95 ± 0.20	15	93	0-2.39
Perennial forbs	0.51 ± 0.11	15	87	0-1.06
Annual forbs	0.06 ± 0.04	15	40	0-0.53
Total Biomass	2.07 ± 0.15	15	100	1.18-3.02
Site 1b				
Agropyron smithii	0.40 ± 0.14	15	53	0-1.80
Bromus tectorum	0.07 ± 0.02	15	47	0-0.16
Oryzopsis hymenoides	0.12 ± 0.09	15	20	0-1.22
Perennial grasses	0.79 ± 0.19	15	80	0-2.39
Perennial forbs	1.17 ± 0.40	15	80	0-5.30
Half shrubs	0.03 ± 0.03	15	13	0-0.47
Total Biomass	2.58 ± 0.51	15	100	0.76-6.68

Table 2.5.3-10 Mean production ± the standard error of the mean (S.E.), frequency, and range of observed values for quadrats in the irrigation/fertilization study plots 1a, 1b, 3a, 3b, 4a, and 4b. Based on data derived from regression equations. Production values in grams/0.10m^2.

Species/ Species Group	Mean ± S.E.	Sample Size	Frequency (%)	Range of Values
FERTILIZED 1980				
<u>Site 3a</u>				
Agropyron smithii	1.64 ± 0.23	15	100	0.40-2.73
Perennial grasses	0.44 ± 0.14	15	80	0-1.78
Perennial forbs	0.37 ± 0.20	15	67	0-2.88
Half shrubs	0.16 ± 0.13	15	13	0-1.90
Total Biomass	2.62 ± 0.30	15	100	0.89-4.72
<u>Site 3b</u>				
Agropyron smithii	0.32 ± 0.13	15	40	0-1.33
Bromus tectorum	0.08 ± 0.03	15	40	0-0.39
Oryzopsis hymenoides	0.24 ± 0.11	15	33	0-1.22
Perennial grasses	0.95 ± 0.25	15	67	0-2.39
Perennial forbs	0.57 ± 0.16	15	73	0-1.67
Annual forbs	0.001 ± 0.001	15	7	0-0.001
Total Biomass	2.17 ± 0.22	15	100	1.10-4.64
<u>Site 4a</u>				
Agropyron smithii	0.67 ± 0.17	15	100	0.02-1.80
Perennial grasses	1.03 ± 0.19	15	93	0-2.39
Perennial forbs	0.27 ± 0.10	15	67	0-1.06
Half shrubs	0.32 ± 0.19	15	27	0-2.62
Total Biomass	2.29 ± 0.20	15	100	0.93-4.07

Table 2.5.3-10 Mean production ± the standard error of the mean (S.E.), frequency, and range of observed values for quadrats in the irrigation/fertilization study plots 1a, 1b, 3a, 3b, 4a, and 4b. Based on data derived from regression equations. Production values in grams/0.10m^2.

Species/ Species Group	Mean ± S.E.	Sample Size	Frequency (%)	Range of Values
Site 4b				
Agropyron smithii	0.80 ± 0.21	15	73	0-2.73
Bromus tectorum	0.08 ± 0.03	15	40	0-0.39
Oryzopsis hymenoides	0.24 ± 0.14	15	20	0-1.86
Perennial grasses	0.63 ± 0.17	15	80	0-2.39
Perennial forbs	0.40 ± 0.10	15	67	0-1.06
Annual forbs	0.004 ± 0.002	15	20	0-0.02
Total Biomass	2.15 ± 0.21	15	100	0.06-3.77
FERTILIZED IN 1980 &1981				
Site 3a				
Agropyron smithii	0.85 ± 0.20	15	93	0-2.26
Perennial grasses	1.07 ± 0.21	15	93	0-2.39
Perennial forbs	0.03 ± 0.03	15	20	0-0.46
Annual forbs	0.001 ± 0.001	15	7	0-0.02
Half Shrubs	0.04 ± 0.03	15	33	0-0.47
Total Biomass	2.00 ± 0.24	15	100	0.46-3.13
Site 3b				
Agropyron smithii	0.50 ± 0.17	15	40	0-1.80
Bromus tectorum	0.07 ± 0.03	15	33	0-0.39
Oryzopsis hymenoides	0.12 ± 0.12	15	7	0-1.86
Perennial grasses	1.11 ± 0.29	15	100	0.04-4.20
Perennial forbs	0.57 ± 0.23	15	73	0-3.48
Annual forbs	0.001 ± 0.001	15	7	0-0.02
Half shrubs	0.06 ± 0.04	15	13	0-0.47
Total Biomass	2.44 ± 0.29	15	100	0.58-4.20

Table 2.5.3-10 Mean production ± the standard error of the mean (S.E.), frequency, and range of observed values for quadrats in the irrigation/fertilization study plots 1a, 1b, 3a, 3b, 4a, and 4b. Based on data derived from regression equations. Production values in grams/0.10m^2.

Species/ Species Group	Mean ± S.E.	Sample Size	Frequency (%)	Range of Values
Site 4a				
Agropyron smithii	0.41 ± 0.12	15	80	0-1.33
Perennial grasses	1.90 ± 0.15	15	100	0.04-2.99
Perenneal forbs	0.23 ± 0.10	15	33	0-1.06
Half shrubs	0.03 ± 0.03	15	7	0-0.47
Total Biomass	2.57 ± 0.18	15	100	1.20-3.85
Site 4b				
Agropyron smithii	0.72 ± 0.16	15	80	0-1.84
Bromus tectorum	0.16 ± 0.04	15	60	0-0.39
Oryzopsis hymenoides	0.12 ± 0.06	15	27	0-0.58
Perennial grasses	0.33 ± 0.12	15	80	0-1.78
Perennial forbs	0.38 ± 0.22	15	60	0-2.88
Annual forbs	0.06 ± 0.04	15	47	0-0.53
Half shrubs	0.21 ± 0.18	15	13	0-2.62
Total Biomass	1.97 ± 0.25	15	100	0.76-4.36

2.5.4 Threatened and Endangered Species

No additional sightings were conducted during this reporting period.

2.5.5 Revegetation

Revegetation studies conducted during 1982 were limited to an analysis of cover for the Revegetation of Raw Shale Demonstration Plot established in the fall of 1981. Other areas on Tract which require an analysis of revegetation are the revegetated Topsoil Storage Piles. However, these areas are not sampled until the third growing season, and none of the Topsoil Piles were in their third year in 1982.

The demonstration plot consists of a portion of the raw shale disposal embankment which is covered with topsoil. The topsoil varies in depth from 18 inches to 6 inches. The plot is subdivided into three sections: 18 inches of topsoil, 12 inches of topsoil, and 6 inches of topsoil. Each section was sampled separately to estimate vegetative cover for the respective topsoil depths.

An estimate of ground cover for each of the topsoil depths was obtained by using the point-intercept method as described in the Office of Surface Mining Publication: "A Survey of Techniques for Measurement of Herbaceous and Shrub Production, Cover and Diversity on Coal Lands in the West"; Bonham, Charles D., Larry L. Larson and Ann Morrison; January 31, 1980; 79 p. This method was used rather than the ocular-estimation method (used on the intensive study plots) in order to attempt to eliminate the tendency for the observer to over estimate ground cover using the ocular method.

An estimate of cover was obtained by sampling 20 one-meter transects per each topsoil depth. The results of sampling are presented in Table 2.5.5-1. Frequency was measured along with cover. The vegetative cover for 18 inches of topsoil depth was 7.95%, for 12 inches of topsoil was 7.65%, and for 6 inches of topsoil depth was 7.20%.

Table 2.5.5-1 Transect summaries for revegetation of raw shale demonstration plot. Based on data derived from 20 point-intercept-transects per each topsoil cover depth. Each transect being 1 meter in length with a possible point inercept at each centimeter, making a total of 100 sample points per individual transect. Data collected July, 1982.

Species Group[1]	Mean Cover (%)	Relative Cover (%)	Frequency (%)
Raw Shale with 18 inches Topsoil Depth			
Perennial Grasses	5.85	73.8	100
Annual Grasses	0.15	1.9	15
Perennial Forbs	1.20	15.1	70
Annual Forbs	0.60	7.5	35
Shrub Seedlings	0.15	1.9	10
Sub-total[2]	7.95		
Bare Ground	2.25		
Rock	0.60		
Litter (mulch)	97.15		
Raw Shale with 12 inches Topsoil Depth			
Perennial Grasses	5.75	75.2	100
Annual Grasses	0.25	3.3	15
Perennial Forbs	1.15	15.0	65
Annual Forbs	0.35	4.6	15
Shrub Seedlings	0.15	1.9	10
Sub-total[2]	7.65		
Bare Ground	1.8		
Rock	0.3		
Litter (mulch)	97.9		
Raw Shale with 6 inches Topsoil Depth			
Perennial Grasses	4.90	68.1	100
Annual Grasses	0.10	1.4	10
Perennial Forbs	1.30	18.0	60
Annual Forbs	0.80	11.1	40
Shrub Seedlings	0.10	1.4	10
Sub-total[2]	7.20		
Litter (mulch)	100.00		

[1]Many of the species were still in a vegetative stage of growth making identification of species difficult. Therefore, rather than risk making incorrect identification the vegetation was grouped into the listed species group.

[2]Sub-totals are equal to the mean total vegetative cover for the respective topsoil depth treatments.

SOIL SURVEY
& PRODUCTIVITY
ASSESSMENT

2.5.6 Soil Survey and Productivity Assessment

No additional studies were conducted during this report period.

DENDROCHRONOLOGY &
DENDROCLIMATOLOGY
STUDIES

2.5.7 Dendrochronology and Dendroclimatology Studies

No additional studies were conducted during this report period.

ARCHAEOLOGICAL
STUDIES

2.6 Archaeological Studies

No additional studies were conducted during this report period.

INDUSTRIAL HEALTH
& SAFETY

2.7 Industrial Health and Safety

Periodic reports on Health and Safety Activities have been requested by the Deputy Conservation Manager. Accident Frequency and Mine Gas Monitoring summaries for this reporting period (June 1982 - December 1982) are presented in this section.

ACCIDENT FREQUENCY

2.7.1 Accident Frequency

Data presented in this section are provided by the Health and Safety Department. Table 2.7.1-1 presents the basic man hours, accident and injury rate data for the period from January, 1982 through December 1982. MSHA inspection reports and citations are on file and are available upon request.

TABLE 2.7.1-1

1982	OCCIDENTAL									CONTRACTOR									OXY & CONTR.								
	MAN HOURS			ACCIDENTS				I.R.		MAN HOURS			ACCIDENTS				I.R.		MAN HOURS			ACCIDENTS				I.R.	
	MONTH	Y.T.D.	QRTR	mon RA	ytd RA	mon LTA	ytd LTA	mon IR	ytd IR	MONTH	Y.T.D.	QRTR.	mon RA	ytd RA	mon LTA	ytd LTA	mon IR	ytd IR	MONTH	Y.T.D.	QRTR.	mon RA	ytd RA	mon LTA	ytd LTA	mon IR	ytd IR
JAN.	16,339	16,339		0	0	0	0	0	0	*			0	0	0	0	*										
FEB.	12,197	28,536		0	0	0	0	0	0	*			1	1	0	0	*										
** MAR	61,899	90,435		0	0	0	0	0	0	*			0	1	0	0	*										
** APR	88,706	179,141		0	1	0	1	0	2.3	94,431			3	4	0	0	4.6										
** MAY	11,833	190,974		0	1	0	1	0	1.8	129,440			4	8	0	0	0	4.6									
JUN	CB 7,245.5	198,218.5	21,608	o	1	1	2	*	*	*			0	8	0	0	0	4.6									
	GJ 9,277.8	207,496.3	95,453																								
JUL	CB Only 4,669	212,165.3		0	1	0	2	*	*	*			0	8	0	0	0	4.6									
	GJ 8,999.2	221,164.5																									
AUG	CB Only 4,669	225,833.5		0	1	0	2	*	*	*			0	8	0	0	0	4.6									
	GJ 8,128	233,961.5																									
SEP	CB Only 4,670	238,631.5	14,008	0	1	0	2	*	*	*			0	8	0	0	0	4.6									
	GJ 7,258	245,889.5	24,385.2																								
OCT	CB 6,164.5	252,054		0	1	0	2	*	*	*			0	8	0	0	0	4.6									
	GJ 5,944.5	257,998.5																									
NOV	CB 7,506	265,504.5		0	1	0	2	*	*	*			0	8	0	0	0	4.6									
	GJ 4,732	270,236.5																									
DEC	CB 3,954	269,458.5		0	1	0	2	*	*	*			0	8	0	0	0	4.6									
	GJ 11,654	281,890.5																									

** Includes personnel located at C-b Tract and administrative offices in Grand Junction (Cathedral Bluffs Shale Oil Company)
* Data not available

MINE GAS
MONITORING

2.7.2 Mine Gas Monitoring

Mine gas samples for CO and methane analysis are required to be taken once every 24 hours from the exhaust air of the Ventilatiion/Escape shaft. These 24-hour values were summarized into weekly averages. All values were 0.0 for June 8 through December 28, 1982.

3.0 Other Studies

Data were collected for two programs for the period June, 1982 through December, 1982. These programs were Micro-environmental Studies and Traffic Load Studies.

3.1 Micro-Climate Program

Introduction

Locations of micro-climate stations with a BC## computer code are presented in Figure 3.1-1.

Micro-climatic parameters monitored from June, 1982 - December, 1982 include the following: 1) Maximum and minimum temperature at surface and at one meter (Table 3.1-1); and 2) Totals for precipitation, snow depth and snow moisture, (Table 3.1-2 and 3.1-3, respectively). Time series plots for the micro-climate parameters are displayed on Figures 3.1-2 through 3.1-6. Snow depth and moisture statistics are shown on Table 3.1-4. Analyses of the micro-climate monitoring program will be included in the Annual Report.

Scope

Studies of micro-climatic parameters on the C-b Tract provide data that are useful in assessing changes in vegetation production and structure, animal populations, or animal activity patterns, and may also be correlated with changes in functional components of the C-b ecosystem that may occur as a result of shale oil development. Five micro-climatic stations are located in developmental sites and five in control sites:

The following sites are monitored:

<u>MC Station Locations</u>

BC01 Chained Pinyon-Juniper Rangeland, Veg. Plot 1
BC02 Chained Pinyon-Juniper Rangeland, Veg. Plot 2
BC03 Plateau Sagebrush, Veg. Plot 3
BC04 Valley Bottom Sagebrush, Veg. Plot 4
BC05 Pinyon-Juniper Woodland, Veg. Plot 5
BC06 Pinyon-Juniper Woodland, Veg. Plot 6
BC07 Chained Pinyon-Juniper Rangeland
(Animal Trapping Transect)
BC08 Bunchgrass Community, South-facing Slope
BC09 Valley Bottom Sagebrush, Mouth of Sorghum Gulch
BC13 Mixed Mountain Shrubland, North-facing Slope

Temperature readings consist of maximum and minimum readings for two-week periods. Precipitation is measured only during the growing season, March through October. Therefore, precipitation data from meteorology station AA23 are utilized for winter-month readings (November-February) for valley and pinyon-juniper microclimate stations. Snow measurements are obtained approximately from November-February.

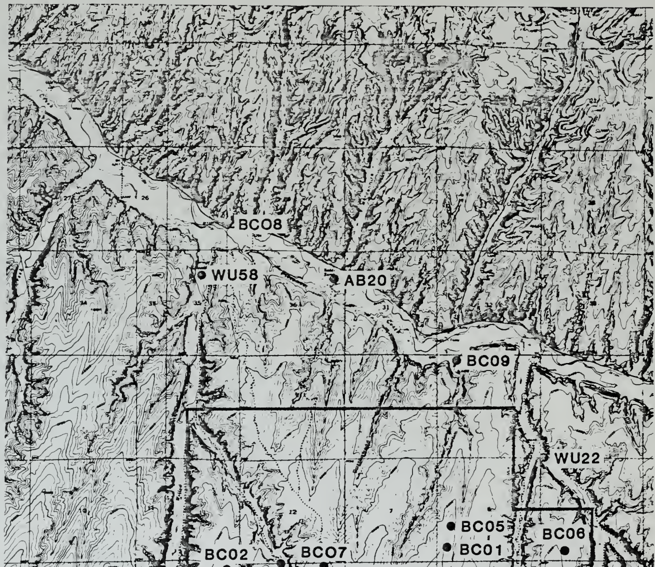


FIGURE 3.1-1
CLIMATOLOGICAL NETWORK NEAR TRACT

TABLE 3.1-1

MICROCLIMATE DATA

AIR SURFACE TEMPERATURES OF MAXIMUM AND MINIMUM VALUES

JUNE 1982 - DECEMBER 1982

STATION	YEAR	MONTH	DAY	TEMP MAXIMUM	TEMP MINIMUM	SURFACE TEMP MAXIMUM	SURFACE TEMP MINIMUM
BC01	82	12	15	7.0	-14.0	6.0	-12.0
BC03	82	7	14	32.0	11.0	40.0	11.0
			30	22.0	10.0	46.0	15.0
		8	16	32.0	12.0	43.0	14.0
		9	15	28.0	-2.0	42.0	7.0
			30	.0	-2.0	35.0	2.0
		10	15	15.0	-9.0	28.0	-3.0
		11	1	17.0	-8.0	32.0	-6.0
			15	5.0	-15.0	23.0	-13.0
		12	1	2.0	-5.0	17.0	-15.0
			15	1.0	-13.0	11.0	-12.0
BC05	82	6	30	40.0	2.0	40.0	5.0
		7	14	40.0	-1.0	39.0	2.0
			30	44.0	7.0	33.0	9.0
		8	16	31.0	10.0	40.0	7.0
		9	1	36.0	6.0	36.0	7.0
			15	36.0	-1.0	32.0	2.0
			30	36.0	1.0	25.0	2.0
		10	15	21.0	-10.0	18.0	-3.0
		11	1	22.0	-11.0	23.0	-10.0
			15	13.0	-16.0	9.0	-15.0
		12	1	10.0	-17.0	10.0	-16.0
BC07	82	6	30	32.0	2.0	35.0	1.0
		7	14	34.0	-2.0	40.0	-1.0
			30	38.0	7.0	38.0	6.0
		8	16	36.0	7.0	35.0	6.0
		9	1	35.0	6.0	36.0	6.0
			15	32.0	-2.0	35.0	-1.0
			30	31.0	.0	24.0	2.0
		10	15	19.0	-12.0	20.0	-9.0
		11	1	17.0	-11.0	24.0	-12.0
			15	10.0	-18.0	15.0	-19.0
		12	1	5.0	-19.0	14.0	-20.0
			15	2.0	-16.0	8.0	-17.0
BC09	82	6	30	35.0	-4.0	42.0	-1.0
		7	14	32.0	4.0	36.0	1.0
			30	37.0	1.0	44.0	3.0
		8	16	34.0	3.0	41.0	5.0
		9	1	34.0	.0	36.0	2.0

TABLE 3.1-1 (Contd)

MICROCLIMATE DATA

AIR SURFACE TEMPERATURES OF MAXIMUM AND MINIMUM VALUES

JUNE 1982 - DECEMBER 1982

STATION	YEAR	MONTH	DAY	TEMP MAXIMUM	TEMP MINIMUM	SURFACE TEMP MAXIMUM	SURFACE TEMP MINIMUM
RC09	82	9	15	31.0	-11.0	36.0	-1.0
			30	26.0	-5.0	30.0	-1.0
		10	15	20.0	-16.0	24.0	-12.0
		11	1	15.0	-14.0	25.0	-14.0
			15	12.0	-25.0	15.0	-18.0
		12	1	10.0	-25.0	13.0	-20.0
			15	8.0	-23.0	10.0	-18.0

TABLE 3.1-2

MICROCLIMATE DATA

PRECIPITATION VALUES

JUNE 1982 - DECEMBER 1982

STATION	YEAR	MONTH	DAY	PRECIPITATION
BC03	82	6	30	.03
		7	14	.04
			30	.87
		8	16	.95
		9	1	.32
			15	1.95
			30	1.54
		10	15	1.00
		11	1	.74
			15	.70
BC05	82	6	30	.13
		7	14	.20
			30	.62
		8	16	1.30
		9	1	.34
			15	1.25
			30	.58
		10	15	.70
		11	1	.52
			15	.60
BC07	82	6	30	.17
		7	14	.30
			30	.72
		8	16	1.50
		9	1	.51
			15	2.00
			30	1.25
		10	15	2.00
		11	1	.64
			15	.64
BC09	82	6	30	.10
		7	14	.34
			30	.50
		8	15	.95
		9	1	.20
			15	1.50
			30	.72
		10	15	.55
		11	1	.44
			15	.54

NOTE: 800.0 = TRACE OF PRECIPITATION

TABLE 3.1-3

MICROCLIMATE DATA

SNOW DEPTH AND SNOW MOISTURE VALUES

JUNE 1982 - DECEMBER 1982

STATION	YEAR	MONTH	DAY	SNOW DEPTH	SNOW MOISTURE
BC01	82	12	15	.0	.0
				.0	.0
				.0	.0
				.0	.0
				.0	.0
				.0	.0
BC03	82	12	1	15.4	2.2
			15	24.0	4.0
				24.0	4.0
				18.0	5.0
				20.0	5.0
				18.0	2.0
				20.8	5.0
BC05	82	12	1	4.0	.8
BC07	82	12	1	7.2	.4
			15	6.0	.0
				8.0	.0
				10.0	1.0
				12.0	3.0
				16.0	3.0
				10.4	1.4
BC09	82	12	1	800.0	.0
			15	6.0	1.0
				10.0	1.0
				800.0	.0
				6.0	1.0
				6.0	1.0
				5.6	.8

NOTE: 800.0 = TRACE OF PRECIPITATION

FIGURE 3.1-2

TIME SERIES PLOT – MAXIMUM AND MINIMUM SURFACE TEMPERATURE

STATION=BC01

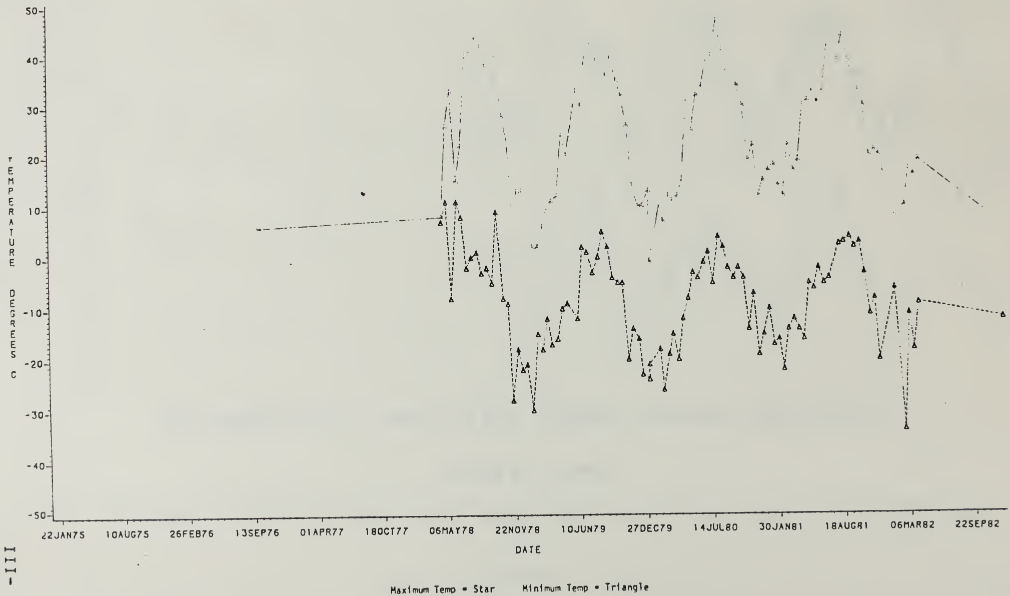
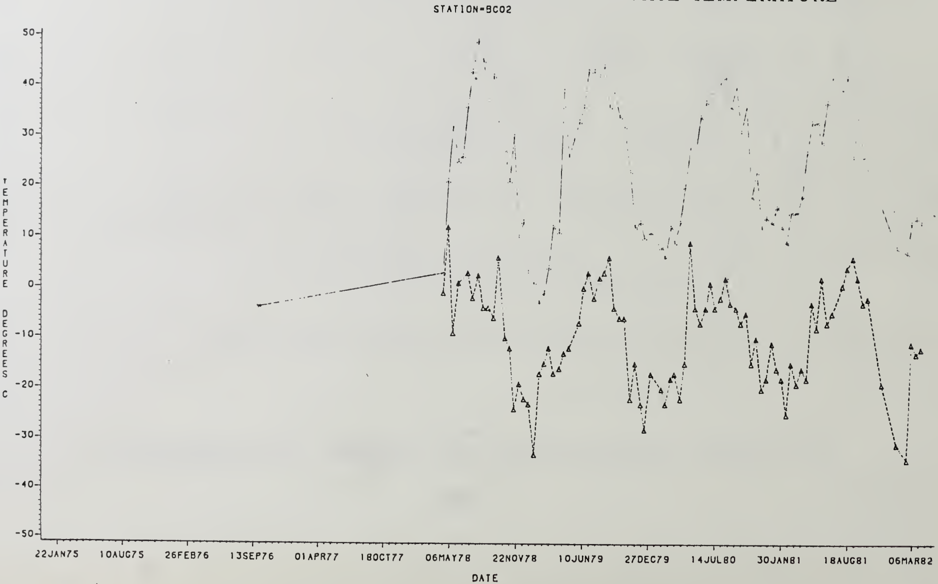


FIGURE 3.1-2 (Contd)

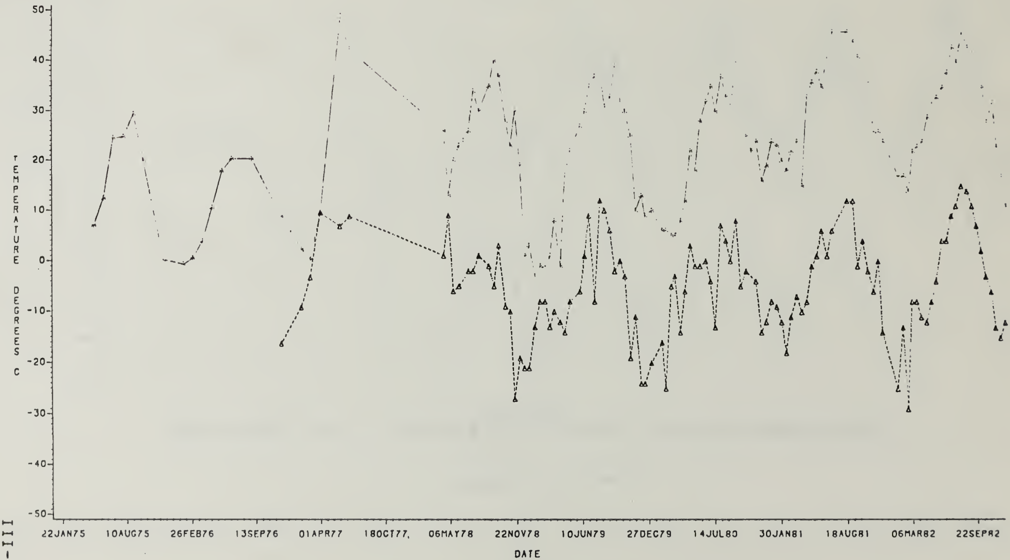
TIME SERIES PLOT – MAXIMUM AND MINIMUM SURFACE TEMPERATURE



Maximum Temp = Star Min Temp = Triangle

FIGURE 3.1-2 (Contd)

TIME SERIES PLOT – MAXIMUM AND MINIMUM SURFACE TEMPERATURE
STATION=BC03



Maximum Temp • Star   Minimum Temp • Triangle

FIGURE 3.1-2 (Contd)

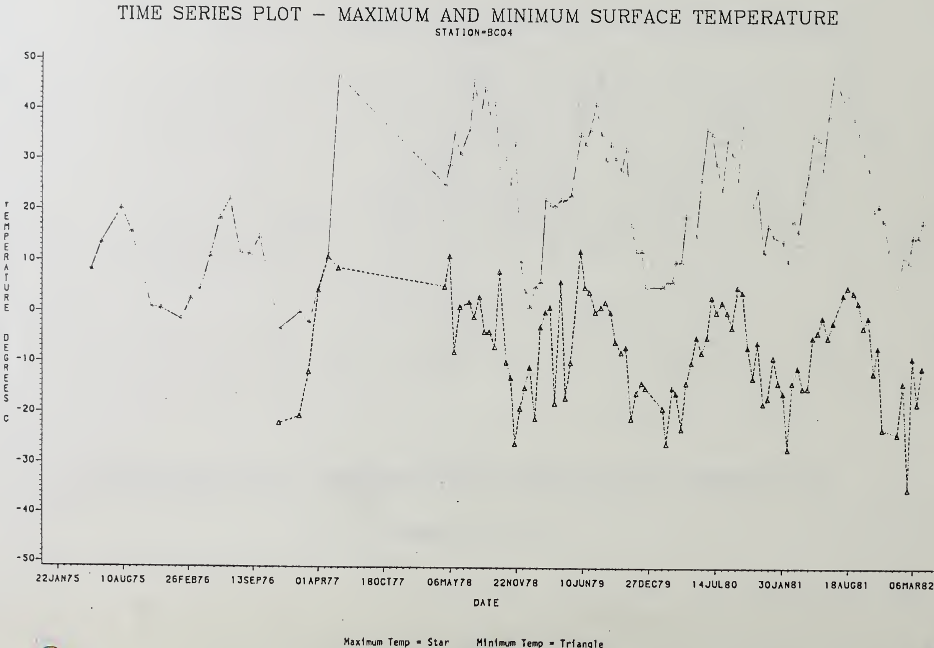
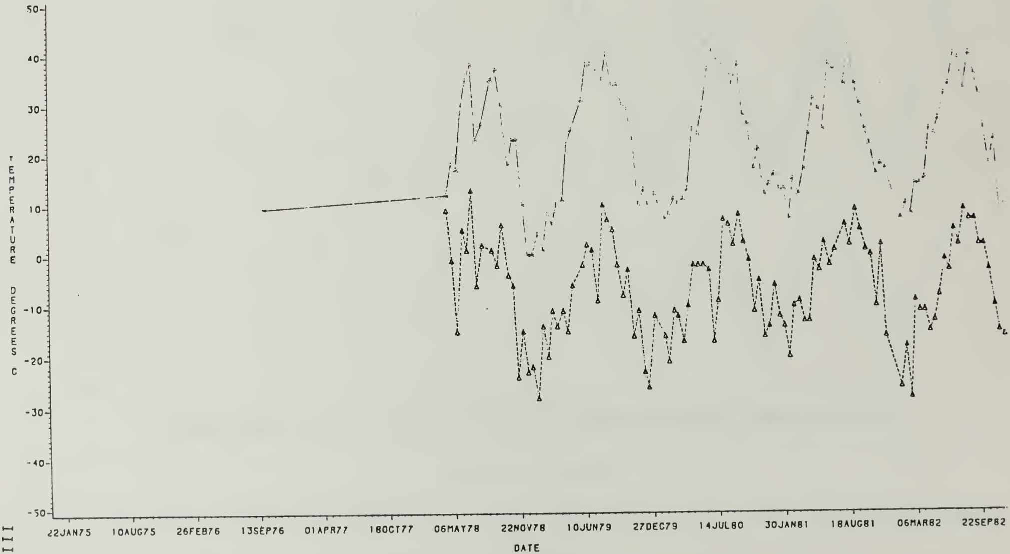


FIGURE 3.1-2 (Contd)

TIME SERIES PLOT – MAXIMUM AND MINIMUM SURFACE TEMPERATURE

STATION=BCOS

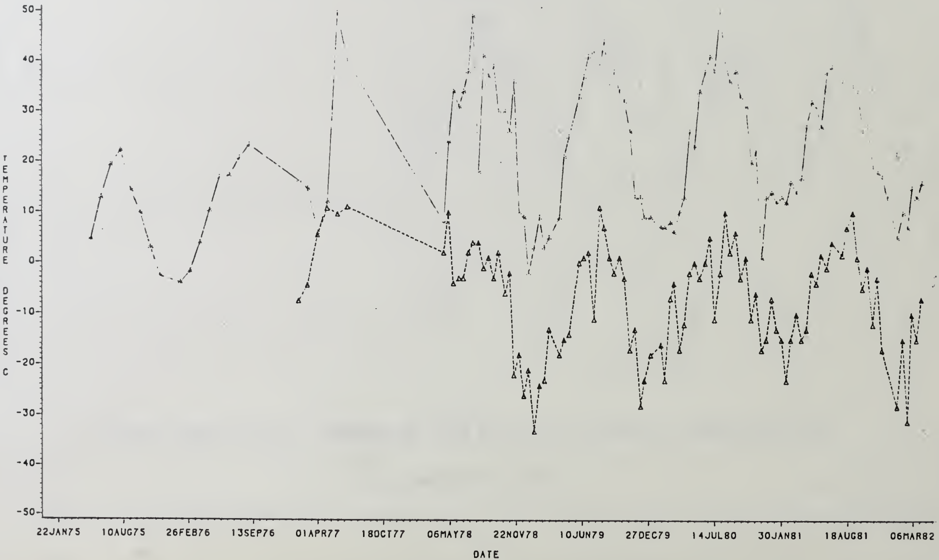


Maximum Temp = Star   Minimum Temp = Triangle

FIGURE 3.1-2 (Contd)

TIME SERIES PLOT – MAXIMUM AND MINIMUM SURFACE TEMPERATURE

STATION=BC06



Maximum Temp = Star   Minimum Temp = Triangle

FIGURE 3.1-2 (Contd)

TIME SERIES PLOT – MAXIMUM AND MINIMUM SURFACE TEMPERATURE

STATION=BC07

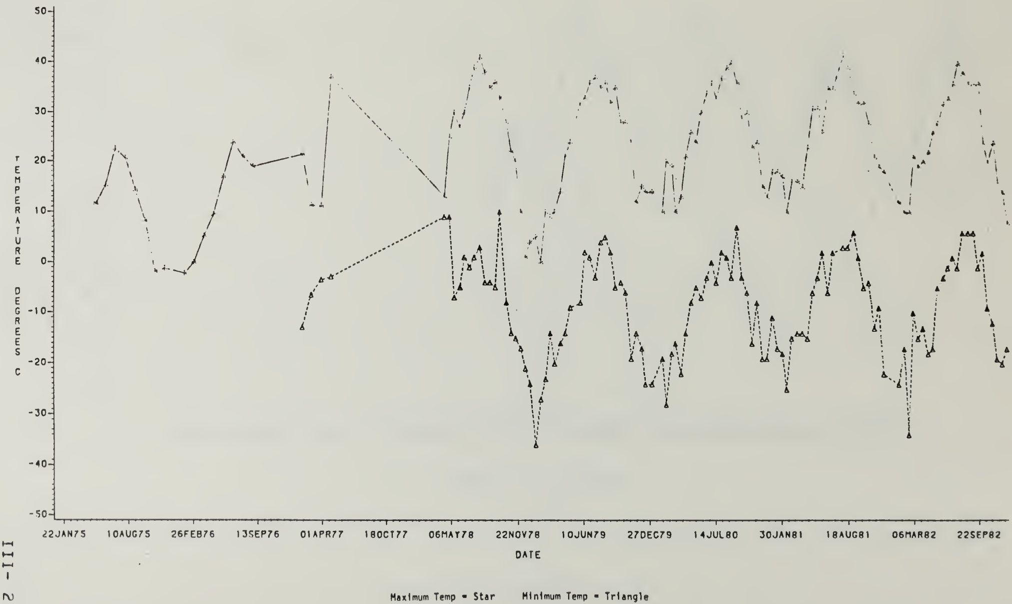


FIGURE 3.1-2 (Contd)

TIME SERIES PLOT – MAXIMUM AND MINIMUM SURFACE TEMPERATURE

STATION=BC08

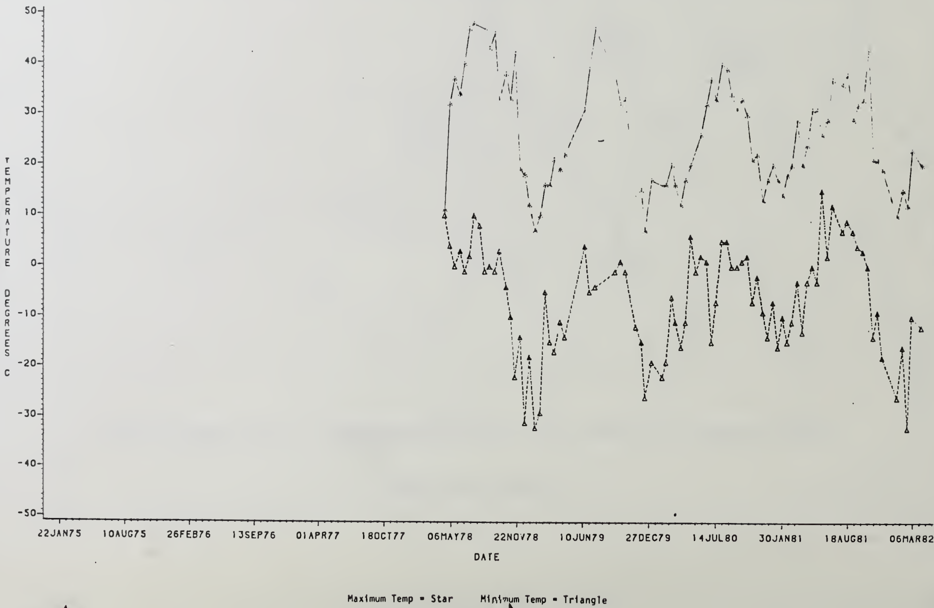


FIGURE 3.1-2 (Contd)

TIME SERIES PLOT — MAXIMUM AND MINIMUM SURFACE TEMPERATURE

STATION-BC09

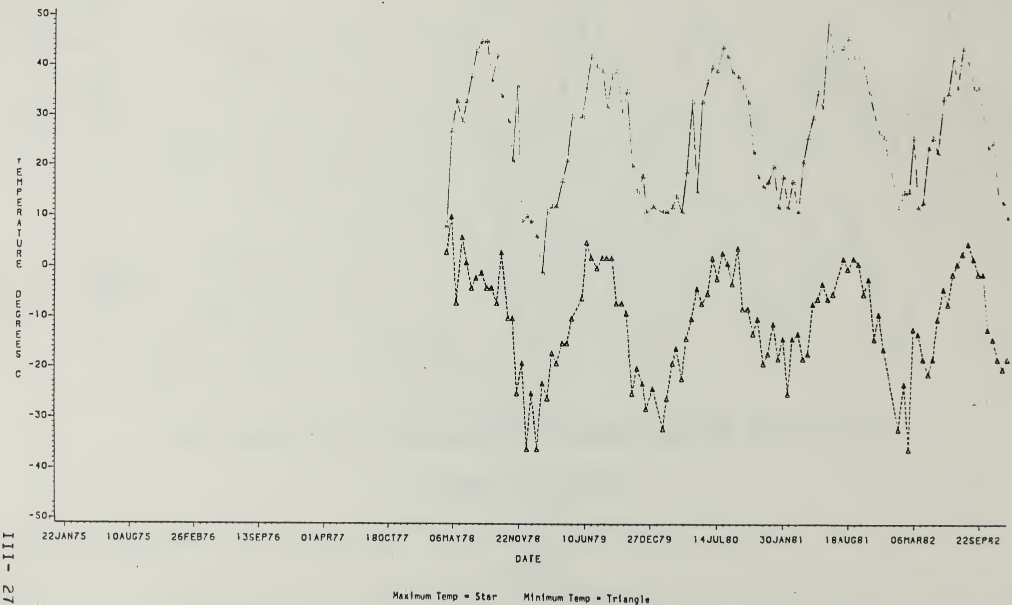
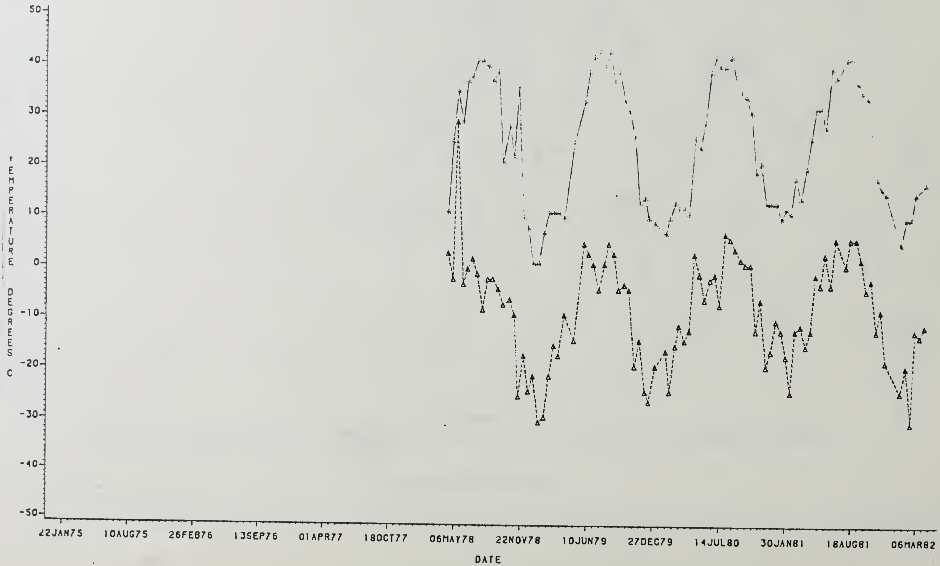


FIGURE 3.1-2 (Contd)

TIME SERIES PLOT — MAXIMUM AND MINIMUM SURFACE TEMPERATURE

STATION=BC13



Maximum Temp = Star   Minimum Temp = Triangle

FIGURE 3.1-3

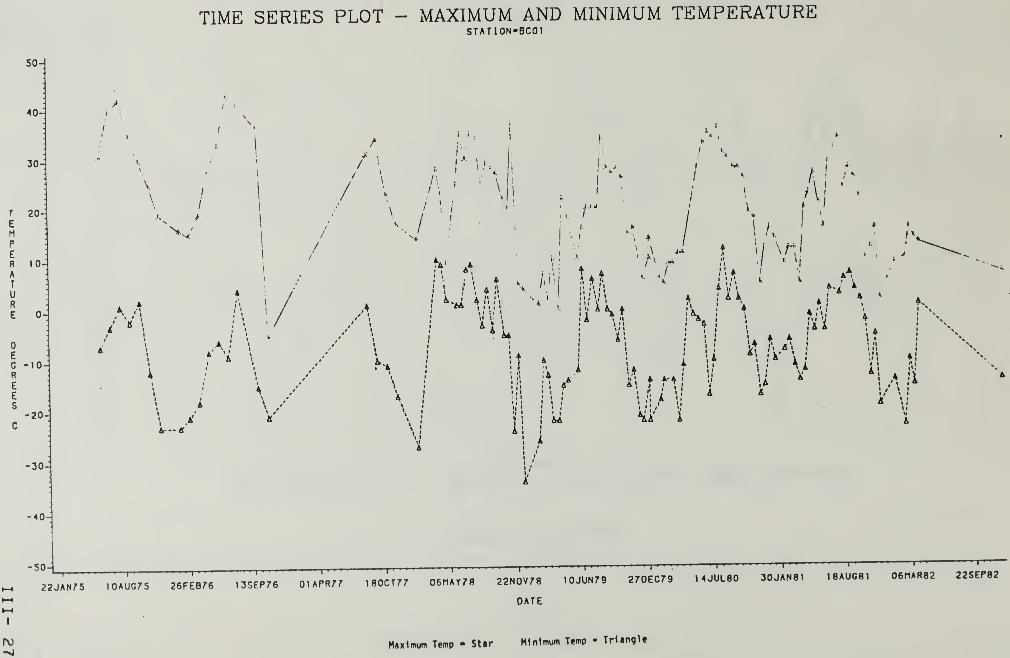
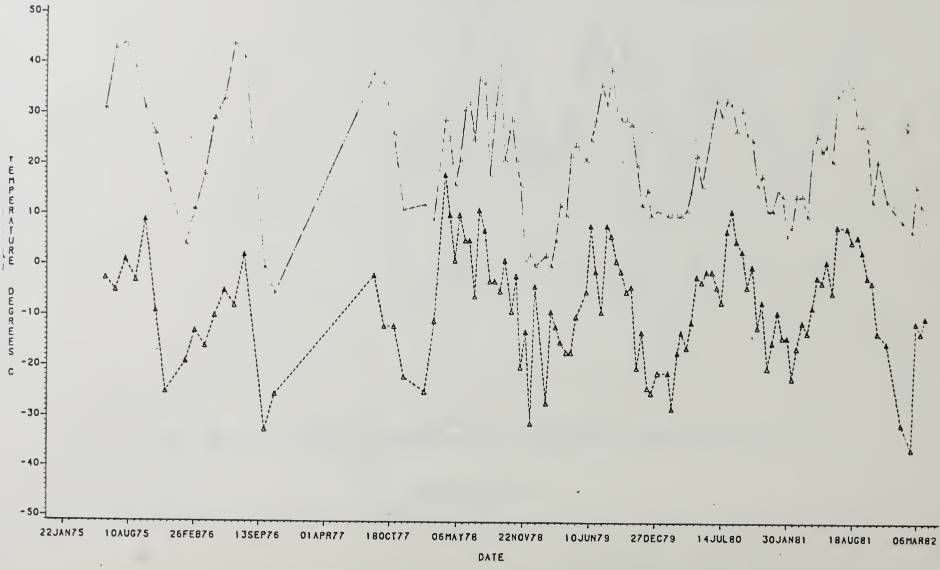

TIME SERIES PLOT – MAXIMUM AND MINIMUM TEMPERATURE
STATION=BC01
TEMPERATURE DEGREES C
50
40
30
20
10
0
-10
-20
-30
-40
-50
22JAN75
10AUG75
26FEB76
13SEP76
01APR77
18OCT77
06MAY78
22NOV78
10JUN79
27DEC79
14JUL80
30JAN81
18AUG81
06MAR82
22SEP82
DATE
Maximum Temp = Star
Minimum Temp = Triangle

FIGURE 3.1-3 (Contd)

TIME SERIES PLOT – MAXIMUM AND MINIMUM TEMPERATURE

STATION=BC02



Maximum Temp = Star   Minimum Temp = Triangle

FIGURE 3.1-3 (Contd)

TIME SERIES PLOT – MAXIMUM AND MINIMUM TEMPERATURE

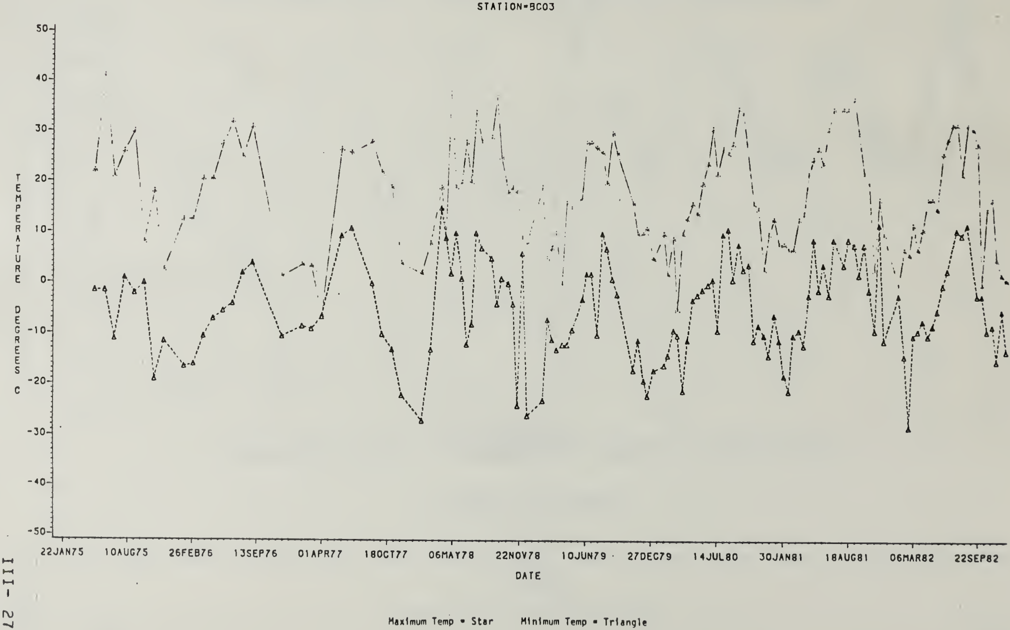


FIGURE 3.1-3 (Contd)

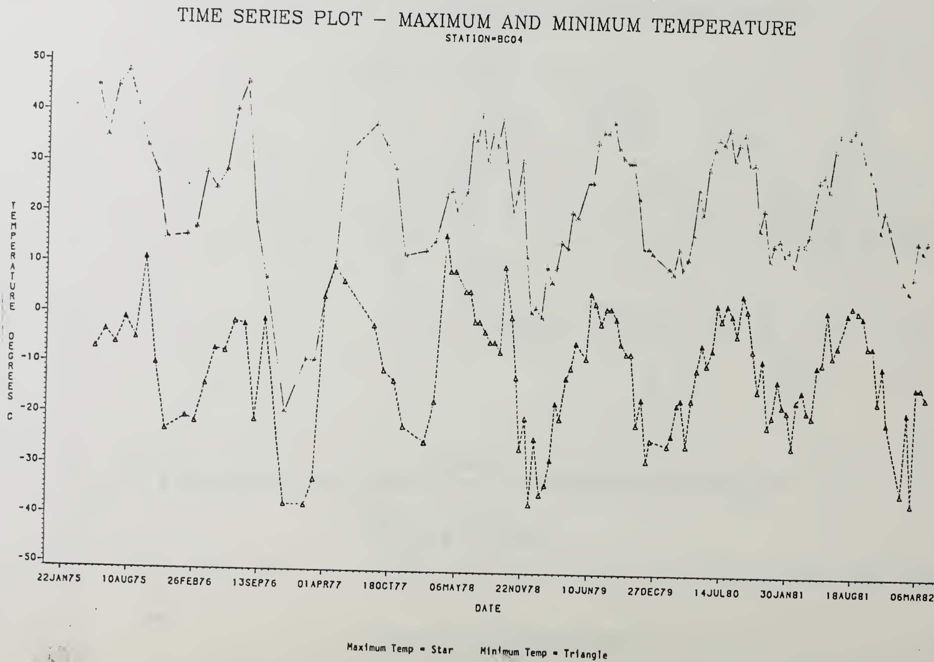
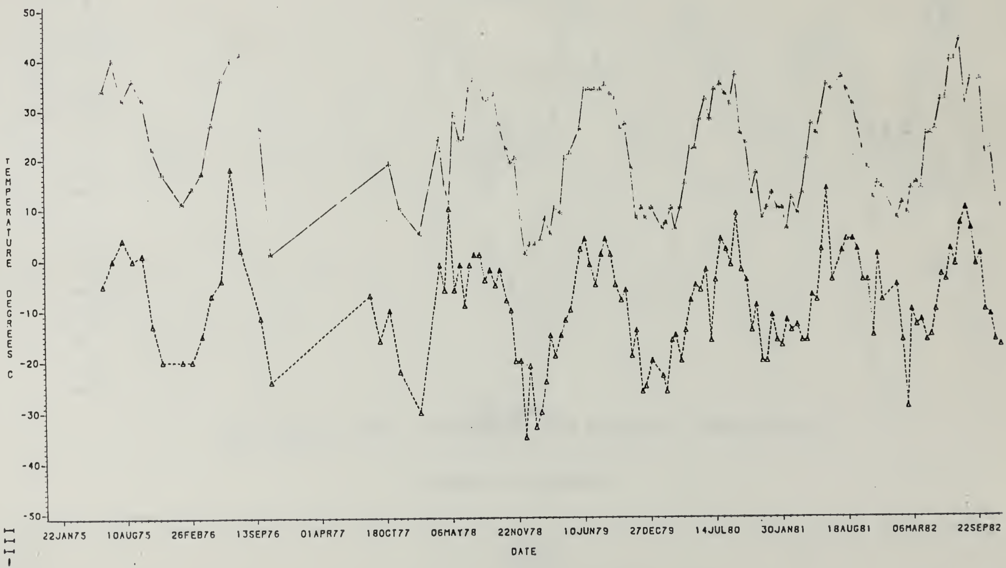


FIGURE 3.1-3 (Contd)

TIME SERIES PLOT – MAXIMUM AND MINIMUM TEMPERATURE

STATION=BCOS



Maximum Temp = Star   Minimum Temp = Triangle

FIGURE 3.1-3 (Contd)

TIME SERIES PLOT – MAXIMUM AND MINIMUM TEMPERATURE

STATION=BC06

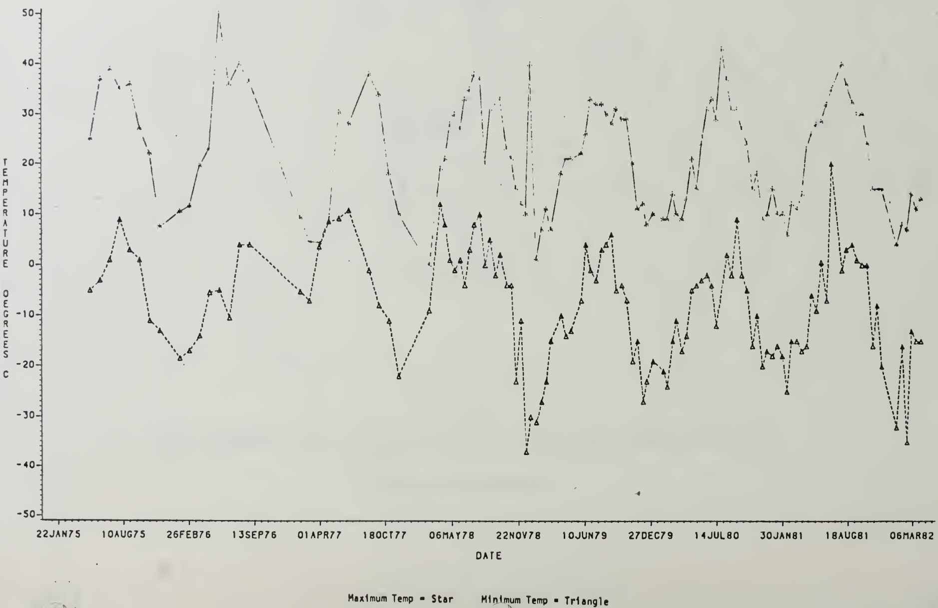


FIGURE 3.1-3 (Contd)

TIME SERIES PLOT – MAXIMUM AND MINIMUM TEMPERATURE

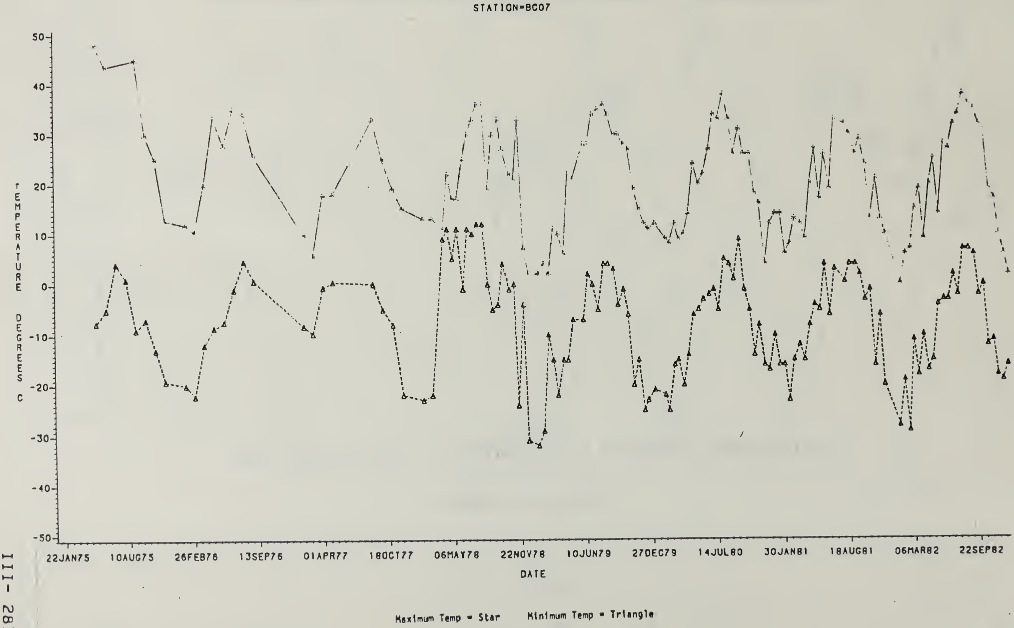
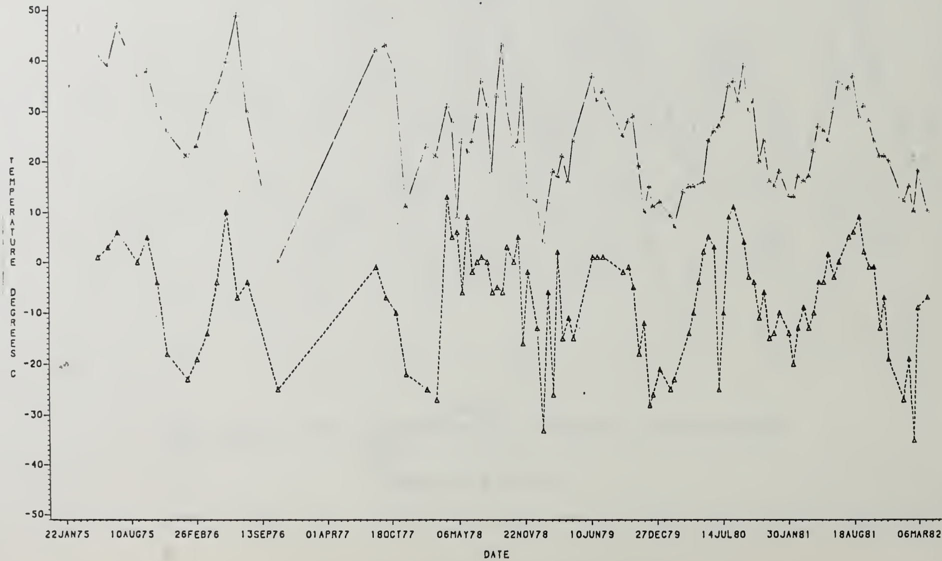


FIGURE 3.1-3 (Contd)

TIME SERIES PLOT – MAXIMUM AND MINIMUM TEMPERATURE

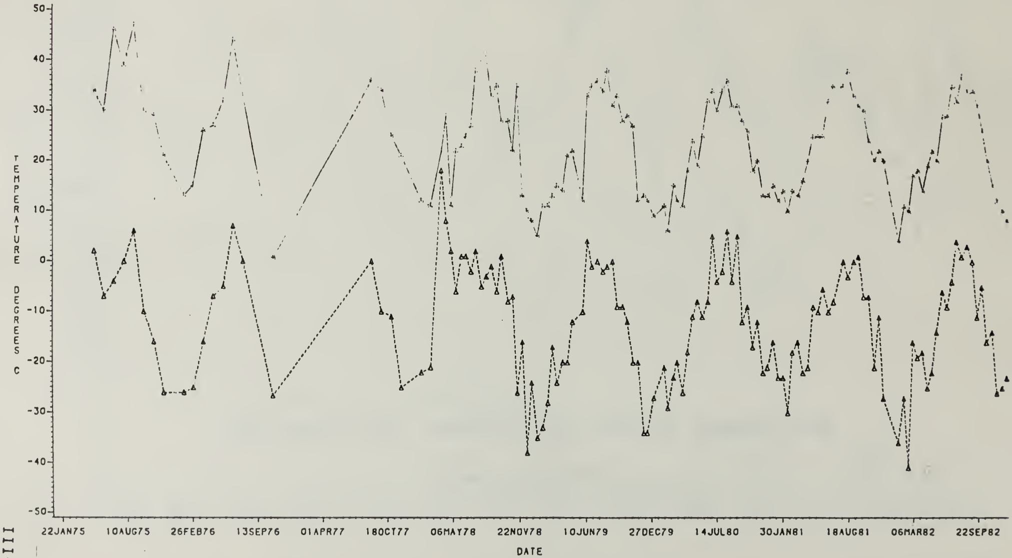
STATION=BC08



Maximum Temp = Star Mi 1 Temp = Triangle

FIGURE 3.1-3 (Contd)

TIME SERIES PLOT – MAXIMUM AND MINIMUM TEMPERATURE
STATION=BC09



Maximum Temp = Star   Minimum Temp = Triangle

FIGURE 3.1-3 (Contd)

TIME SERIES PLOT — MAXIMUM AND MINIMUM TEMPERATURE

STATION=BC13

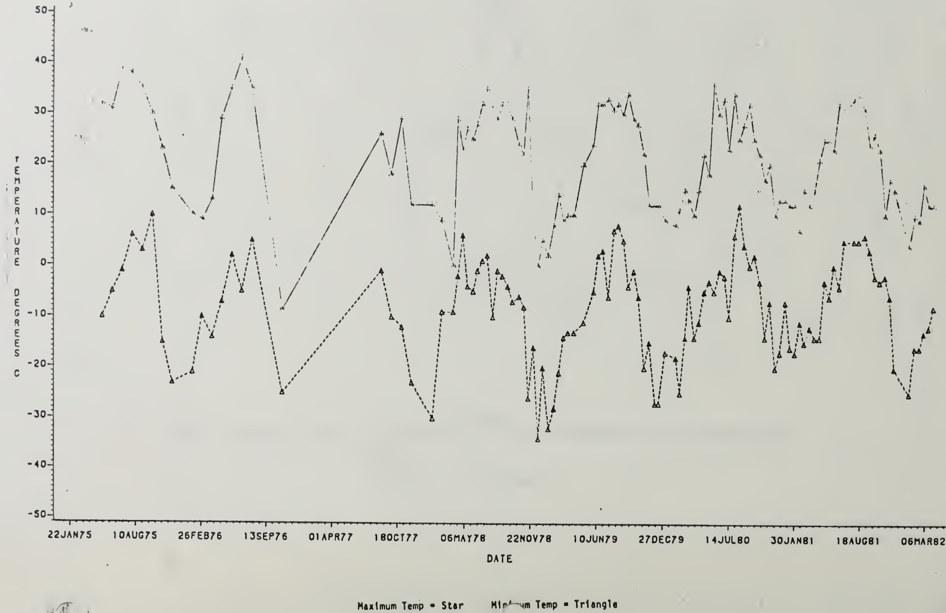


FIGURE 3.1-4 (Contd)

TIME SERIES PLOT – PRECIPITATION

STATION=BC02

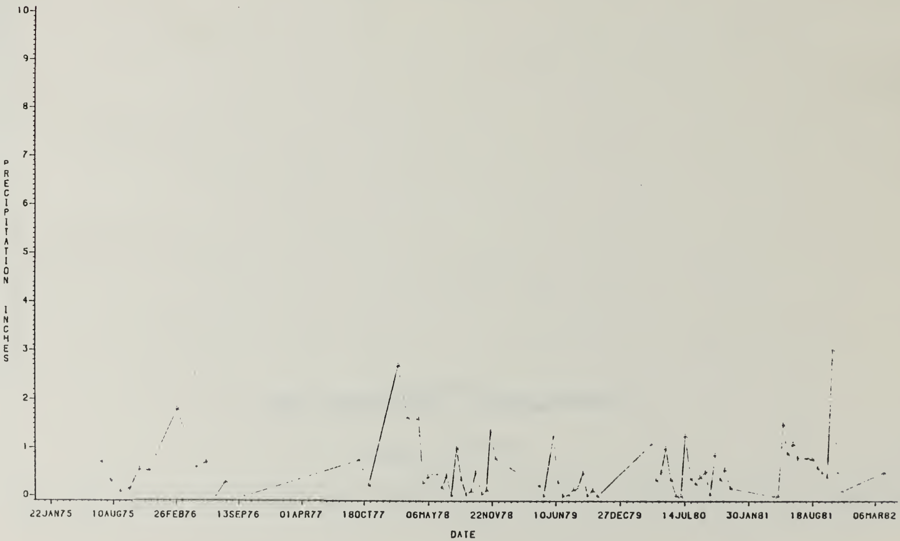


FIGURE 3.1-4 (Contd)

TIME SERIES PLOT – PRECIPITATION

STATION=BC02

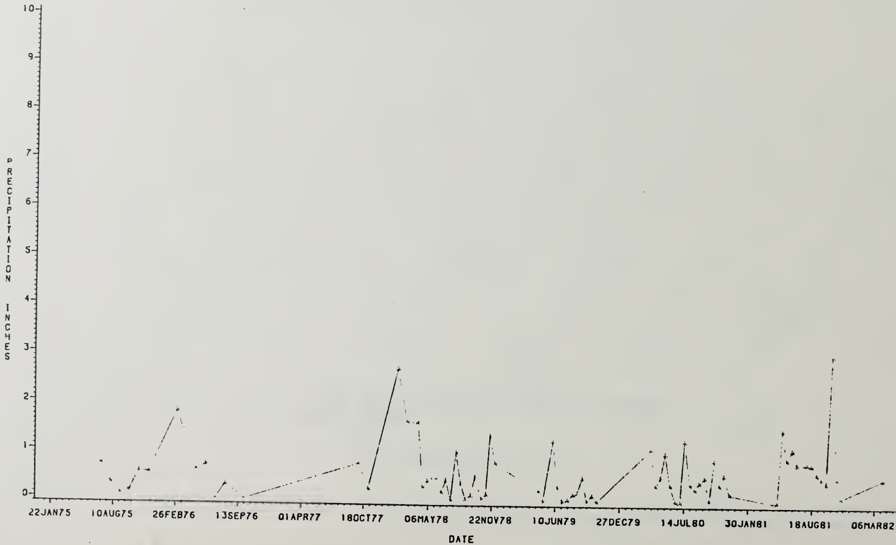


FIGURE 3.1-4 (Contd)

TIME SERIES PLOT – PRECIPITATION
STATION=BC03

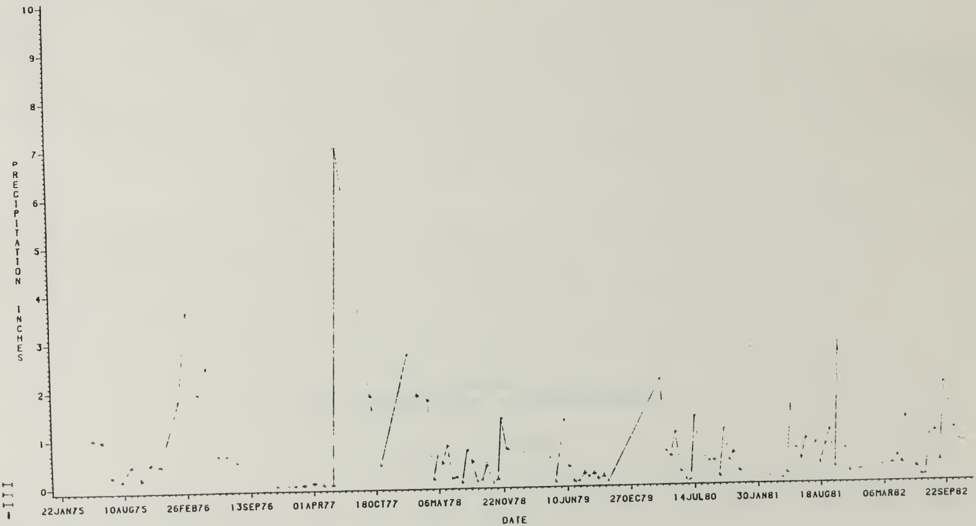


FIGURE 3.1-4 (Contd)

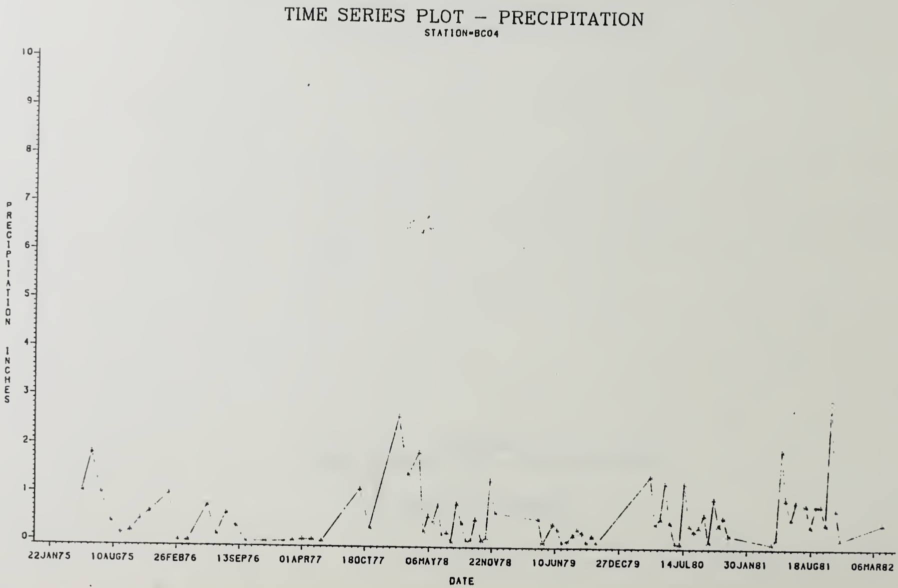


FIGURE 3.1-4 (Contd)

TIME SERIES PLOT – PRECIPITATION

STATION=BCOS

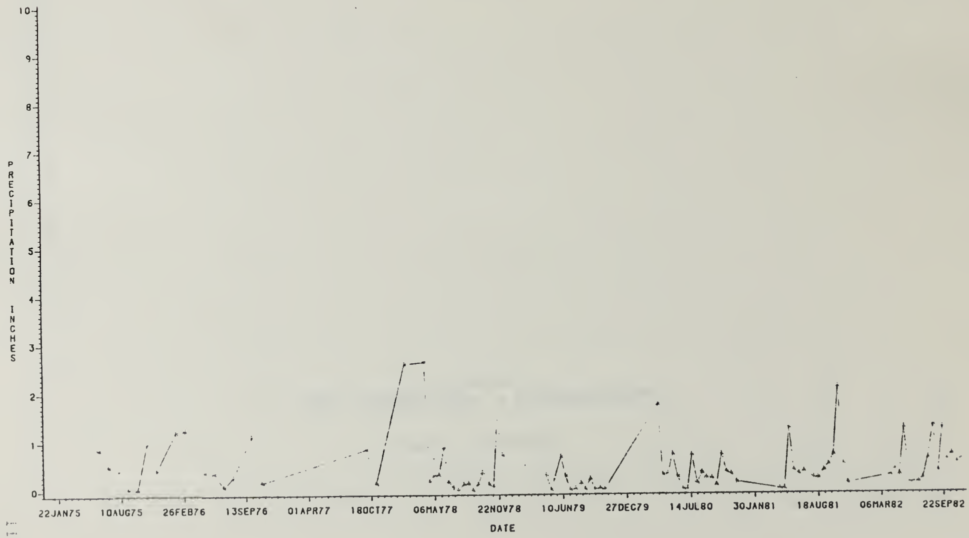


FIGURE 3.1-4 (Contd)

TIME SERIES PLOT – PRECIPITATION

STATION=BC06

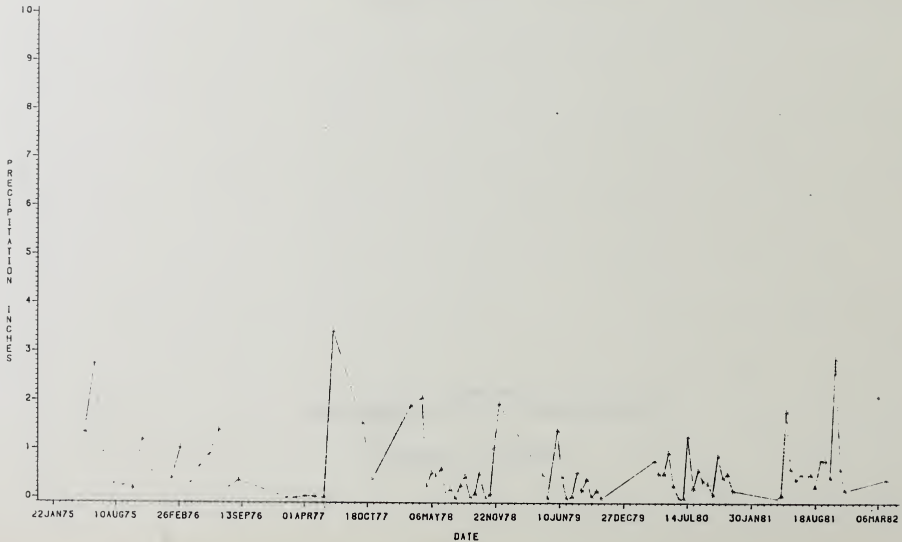


FIGURE 3.1-4 (Contd)

TIME SERIES PLOT – PRECIPITATION

STATION=BC07

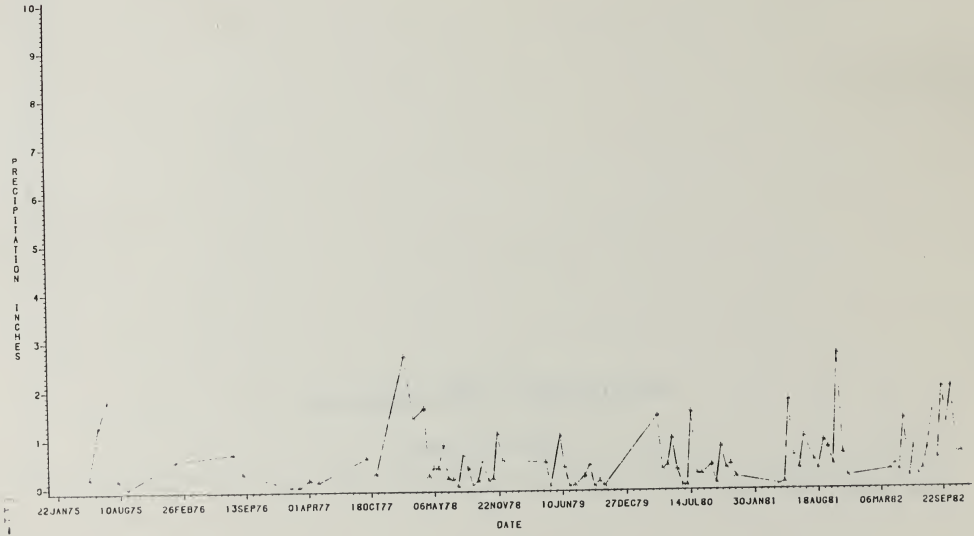


FIGURE 3.1-4 (Contd)

TIME SERIES PLOT – PRECIPITATION

STATION-BC08

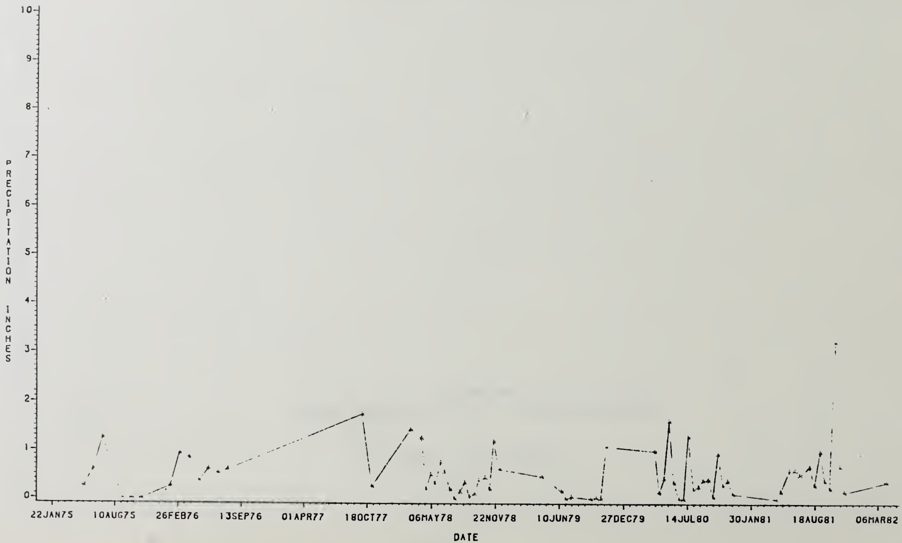


FIGURE 3.1-4 (Contd)

TIME SERIES PLOT – PRECIPITATION

STATION=BC09

FIGURE 3.1-4 (Contd)

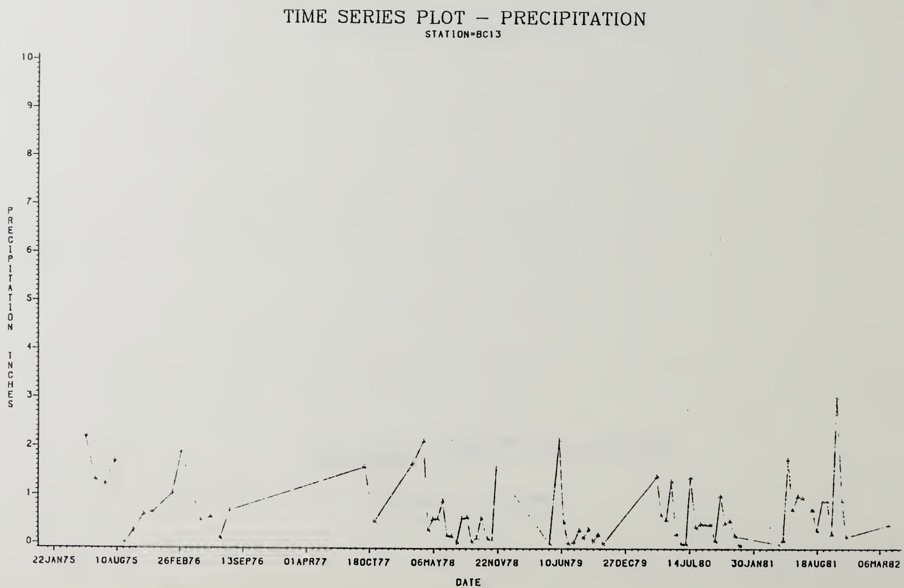


FIGURE 3.1-5

TIME SERIES PLOT – SNOW DEPTH

STATION=BC01

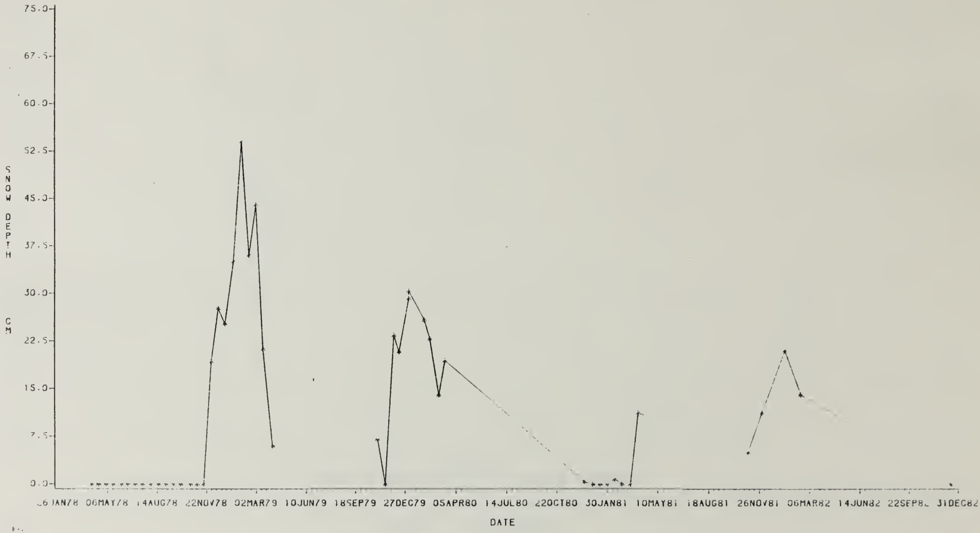


FIGURE 3.1-5 (Contd)

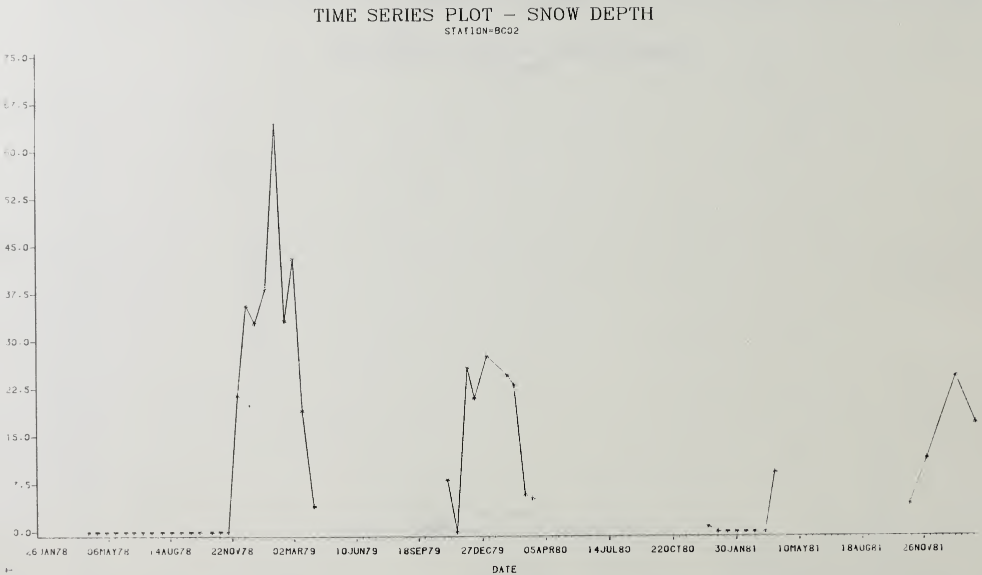


FIGURE 3.1-5 (Contd)

TIME SERIES PLOT – SNOW DEPTH

STATION=BC03

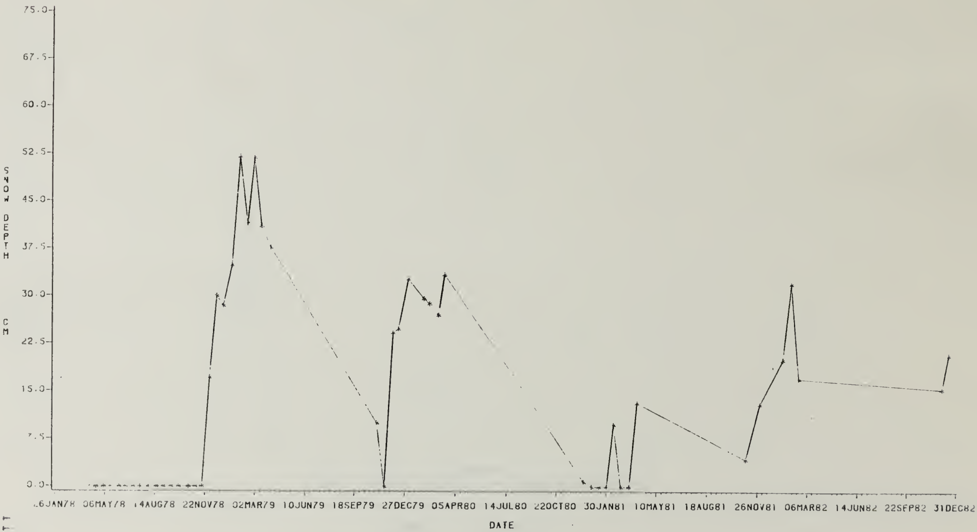


FIGURE 3.1-5 (Contd)

TIME SERIES PLOT – SNOW DEPTH

STATION=BC04

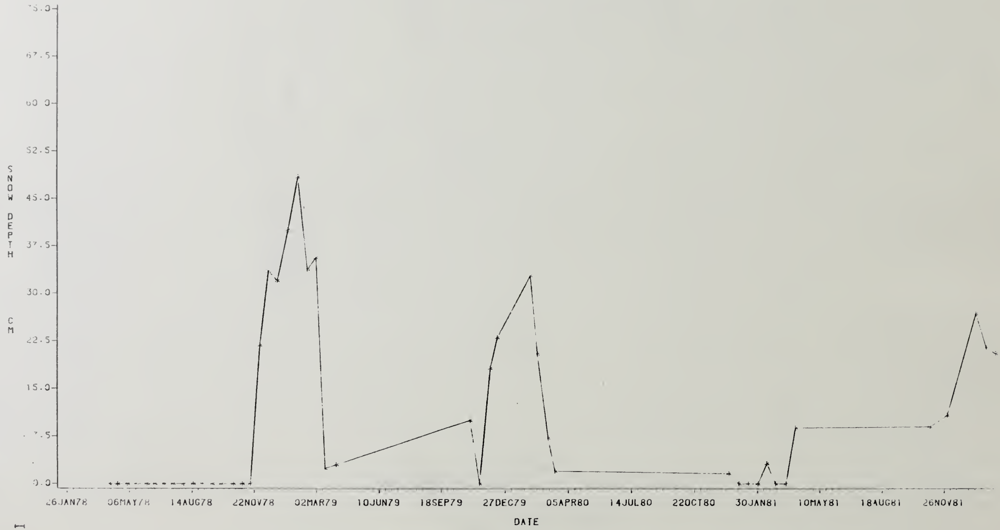


FIGURE 3.1-5 (Contd)

TIME SERIES PLOT – SNOW DEPTH

STATION=BC05

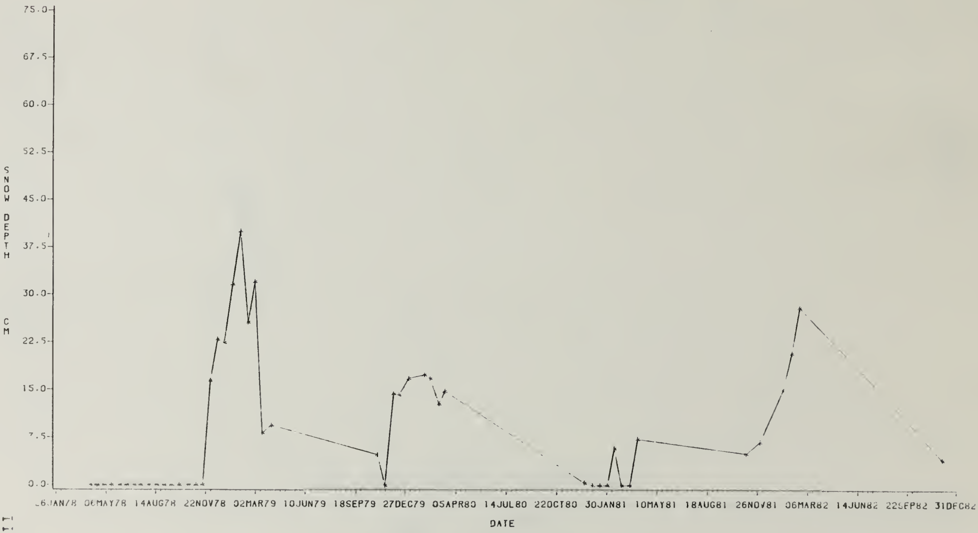


FIGURE 3.1-5 (Contd)

TIME SERIES PLOT — SNOW DEPTH

STATION=BC06

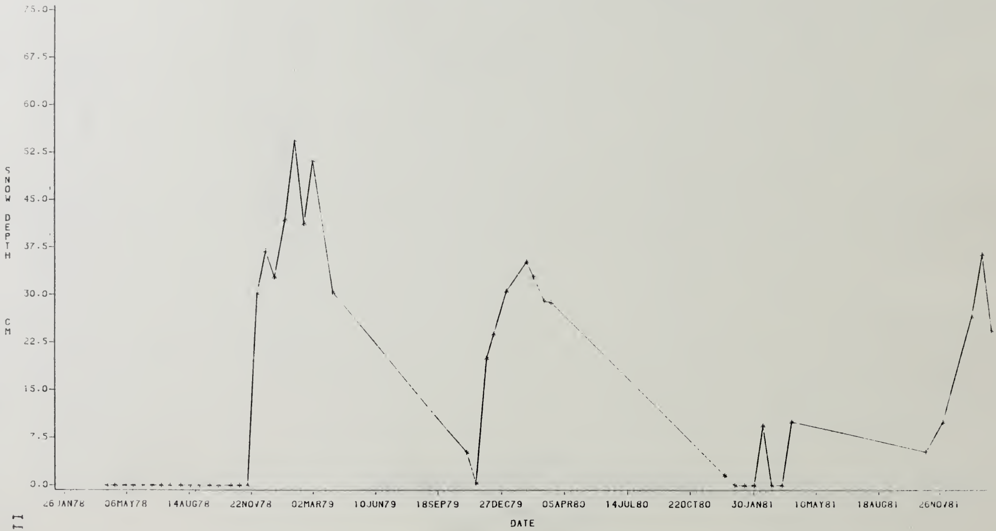


FIGURE 3.1-5 (Contd)

TIME SERIES PLOT – SNOW DEPTH

STATION=BC07

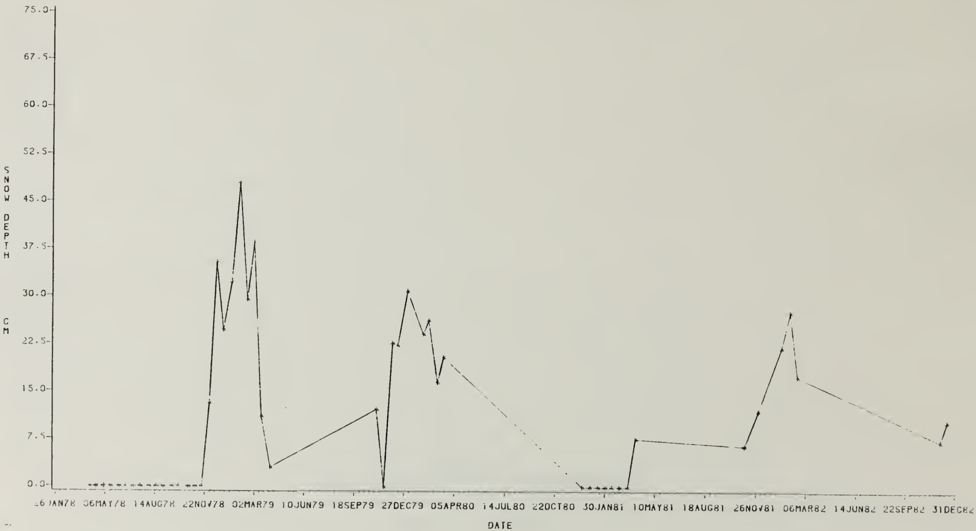


FIGURE 3.1-5 (Contd)

TIME SERIES PLOT – SNOW DEPTH

STATION=BC08

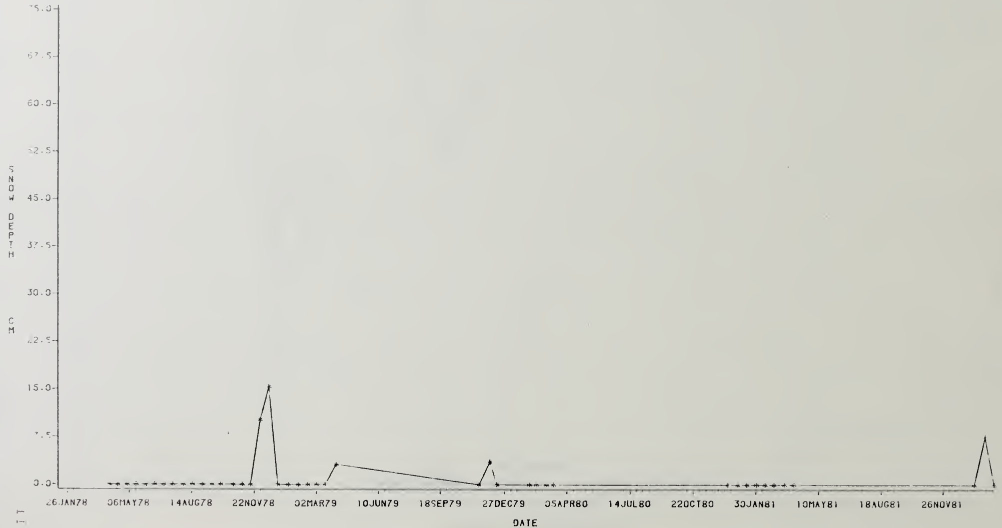


FIGURE 3.1-5 (Contd)

TIME SERIES PLOT – SNOW DEPTH

STATION=BC09

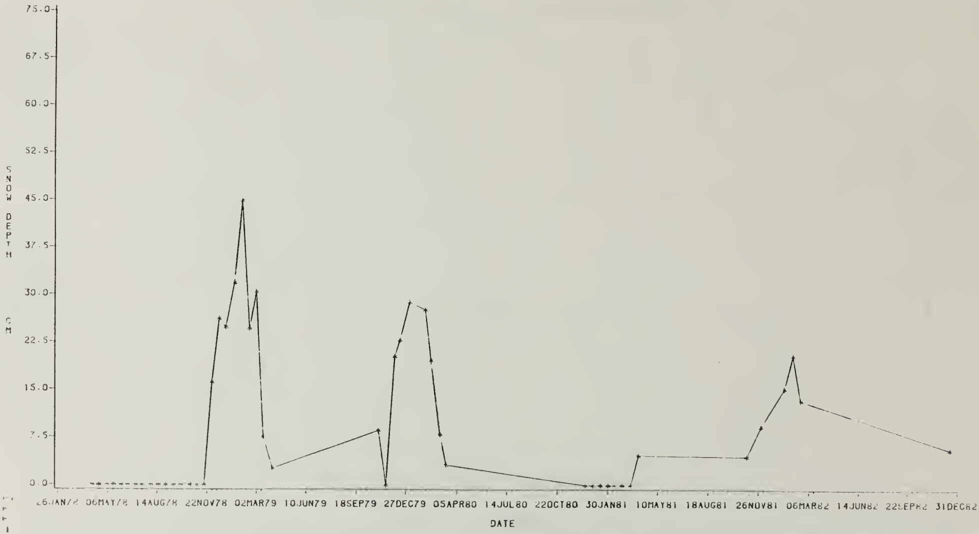


FIGURE 3.1-5 (Contd)

TIME SERIES PLOT – SNOW DEPTH

STATION=BC13

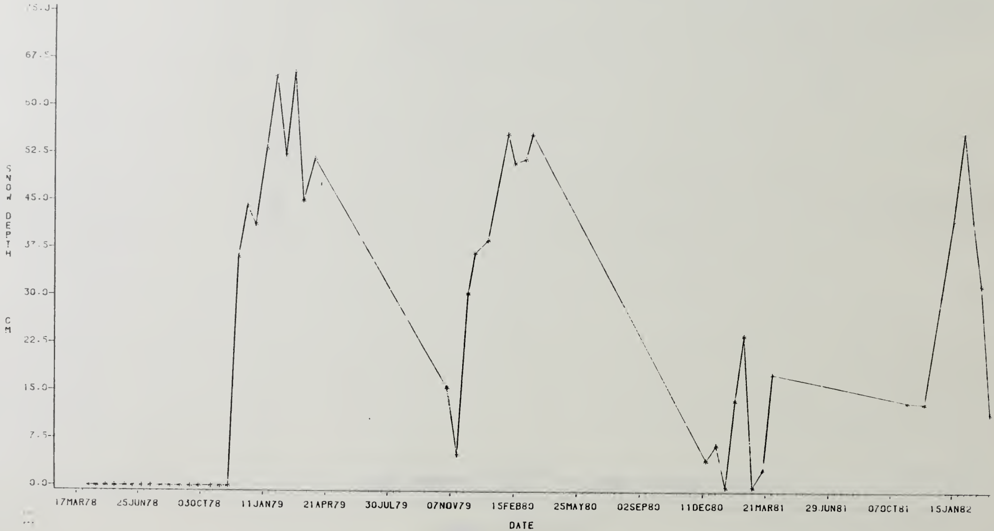


FIGURE 3.1-6

TIME SERIES PLOT – SNOW MOISTURE

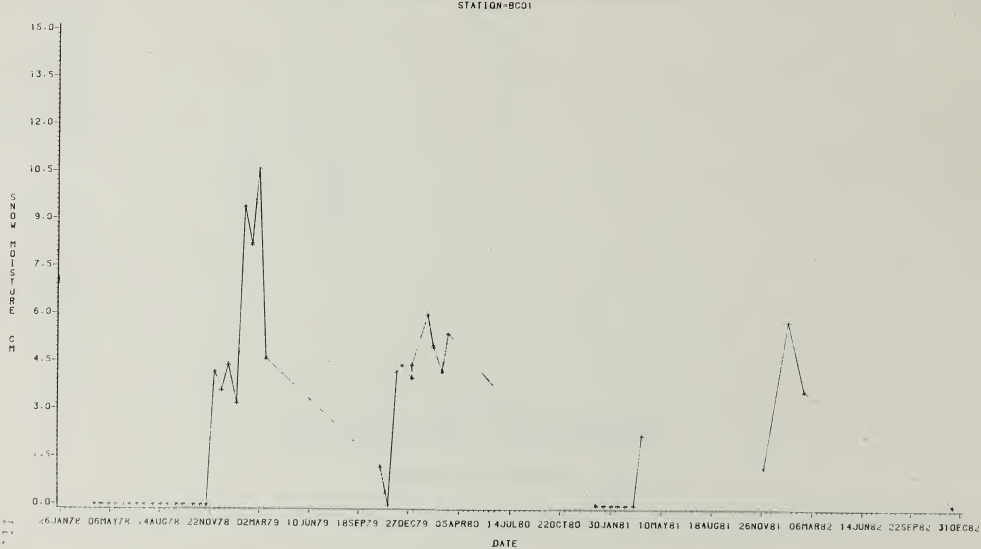


FIGURE 3.1-6 (Contd)

TIME SERIES PLOT - SNOW MOISTURE

STATION=BC02

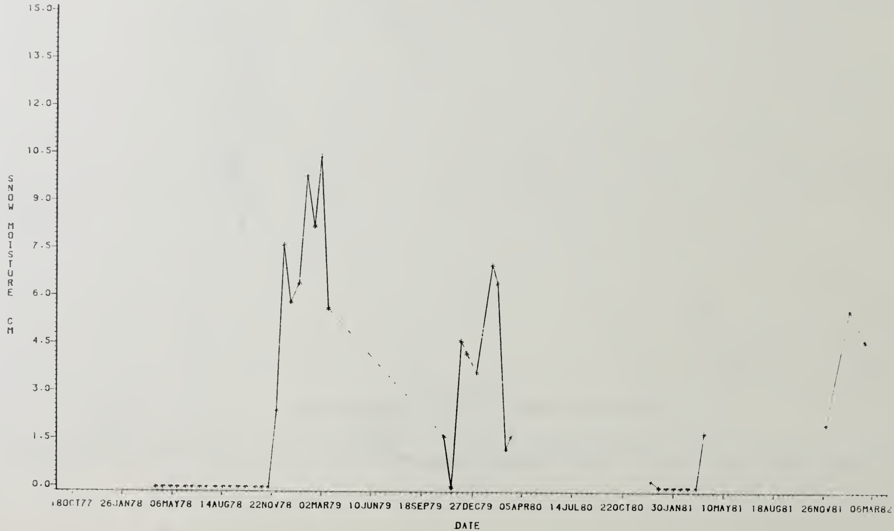


FIGURE 3.1-6 (Contd)

TIME SERIES PLOT – SNOW MOISTURE

STATION=BC03

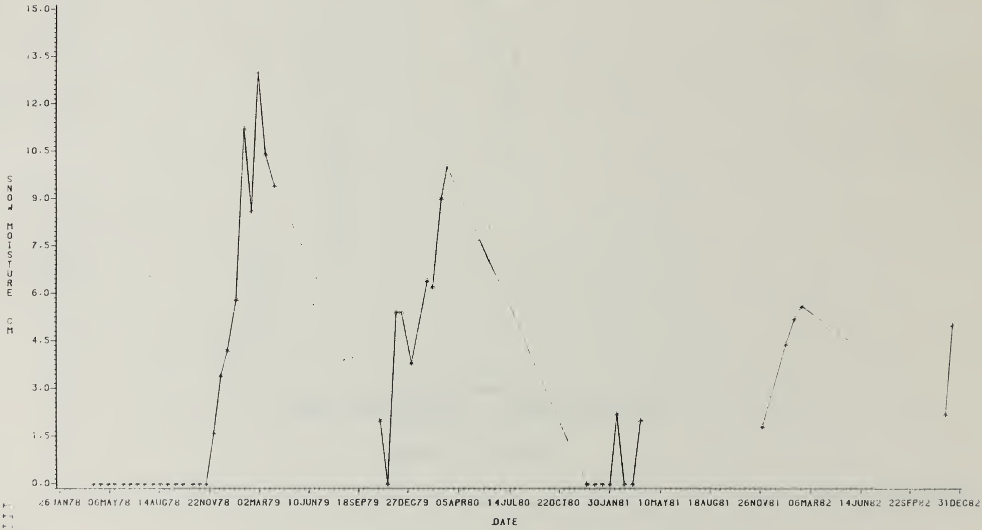


FIGURE 3.1-6 (Contd)

TIME SERIES PLOT – SNOW MOISTURE

STATION=BC04

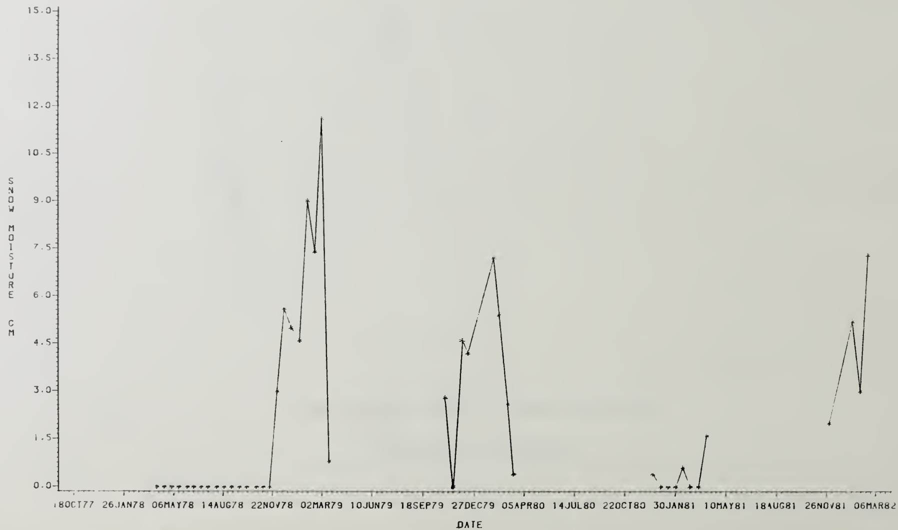


FIGURE 3.1-6 (Contd)

TIME SERIES PLOT – SNOW MOISTURE

STATION=BC05

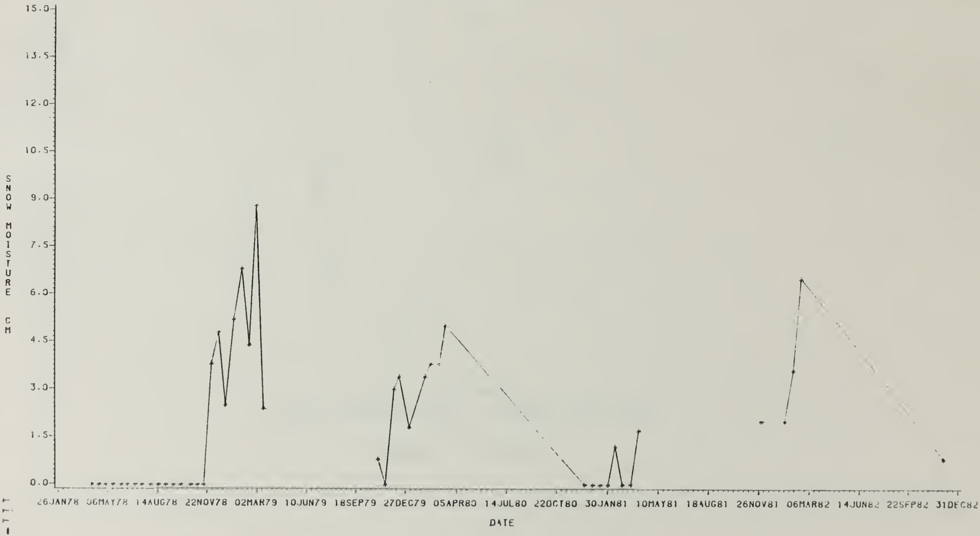


FIGURE 3.1-6 (Contd)

TIME SERIES PLOT – SNOW MOISTURE

STATION=BC06

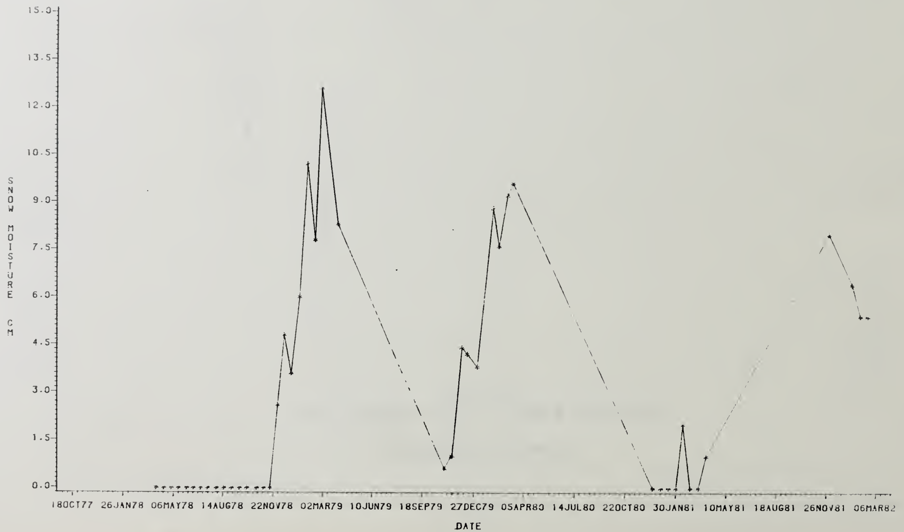


FIGURE 3.1-6 (Contd)

TIME SERIES PLOT – SNOW MOISTURE

STATION=BC07

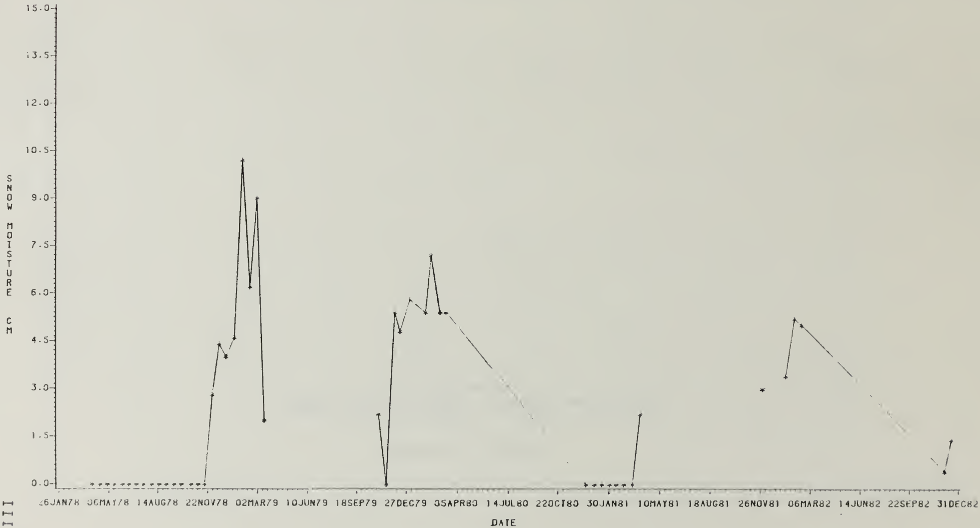


FIGURE 3.1-6 (Contd)

TIME SERIES PLOT – SNOW MOISTURE
STATION=BC08

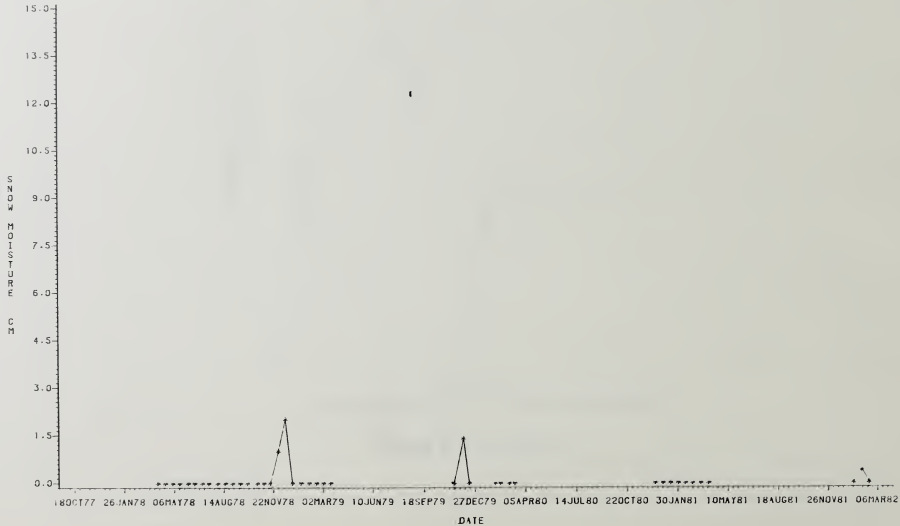


FIGURE 3.1-6 (Contd)

TIME SERIES PLOT – SNOW MOISTURE

STATION=BC09

FIGURE 3.1-6 (Contd)

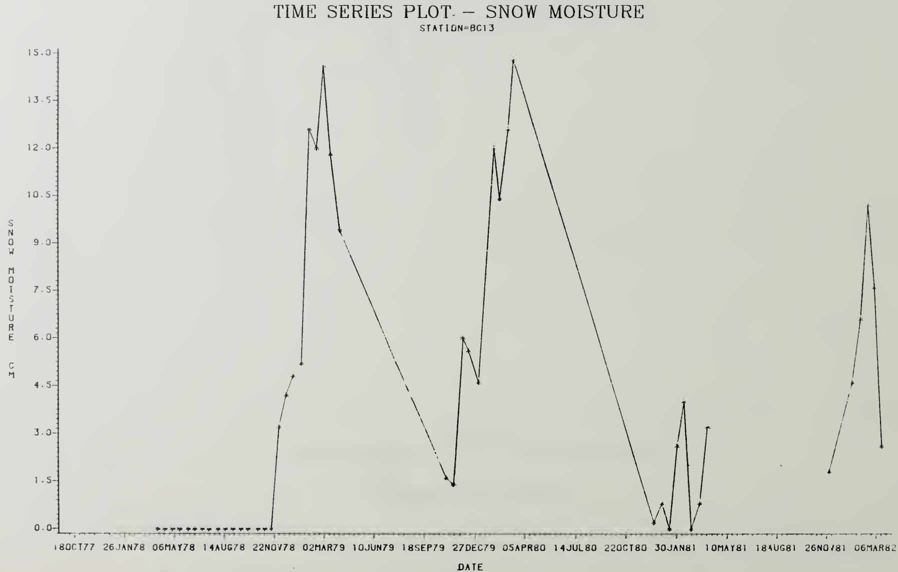


TABLE 3.1-7

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
			STATION=BC01	YEAR=78	MONTH=12		
SND	3	24.00	4.33	19.20	27.60	18.72	18.03
SNM	3	4.07	0.42	3.60	4.40	0.17	10.24
			STATION=BC01	YEAR=79	MONTH=1		
SND	2	44.50	13.44	35.00	54.00	180.50	30.19
SNM	2	6.30	4.38	3.20	9.40	19.22	69.59
			STATION=BC01	YEAR=79	MONTH=2		
SND	1	36.00	.	36.00	36.00	.	.
SNM	1	8.20	.	8.20	8.20	.	.
			STATION=BC01	YEAR=79	MONTH=3		
SND	2	32.60	16.12	21.20	44.00	259.92	49.45
SNM	2	7.60	4.24	4.60	10.60	18.00	55.82
			STATION=BC01	YEAR=79	MONTH=4		
SND	1	6.00	.	6.00	6.00	.	.
SNM	0	.	.	.	.	.	.
			STATION=BC01	YEAR=79	MONTH=11		
SND	2	3.50	4.95	0	7.00	24.50	141.42
SNM	2	0.60	0.85	0	1.20	0.72	141.42
			STATION=BC01	YEAR=79	MONTH=12		
SND	2	22.10	1.84	20.80	23.40	3.38	8.32
SNM	2	4.30	0.14	4.20	4.40	0.02	3.29
			STATION=BC01	YEAR=80	MONTH=1		
SND	2	29.80	0.85	29.20	30.40	0.72	2.85
SNM	2	4.20	0.28	4.00	4.40	0.08	6.73
			STATION=BC01	YEAR=80	MONTH=2		
VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
SND	2	24.30	2.12	22.80	25.80	4.50	8.73
SNM	2	5.50	0.71	5.00	6.00	0.50	12.86
			STATION=BC01	YEAR=80	MONTH=3		
SND	2	16.70	3.82	14.00	19.40	14.58	22.86
SNM	2	4.80	0.85	4.20	5.40	0.72	17.68

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC01 YEAR=80 MONTH=12							
SND	2	0.20	0.28	0	0.40	0.08	141.42
SNM	1	0.00	.	0	0.00	.	.
STATION=BC01 YEAR=81 MONTH=1							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC01 YEAR=81 MONTH=2							
SND	2	0.40	0.57	0	0.80	0.32	141.42
SNM	2	0.00	0.00	0	0.00	0.00	.
STATION=BC01 YEAR=81 MONTH=3							
SND	2	5.60	7.92	0	11.20	62.72	141.42
SNM	2	1.10	1.56	0	2.20	2.42	141.42
STATION=BC01 YEAR=81 MONTH=11							
SND	2	8.10	4.38	5.00	11.20	19.22	54.12
SNM	1	1.20	.	1.20	1.20	.	.
STATION=BC01 YEAR=82 MONTH=1							
SND	1	21.00	.	21.00	21.00	.	.
SNM	1	5.80	.	5.80	5.80	.	.
STATION=BC01 YEAR=82 MONTH=2							
SND	1	14.00	.	14.00	14.00	.	.
SNM	1	3.60	.	3.60	3.60	.	.

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE*	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC02 YEAR=78 MONTH=12							
SND	3	29.93	7.52	21.40	35.60	56.57	25.13
SNM	3	5.27	2.64	2.40	7.60	6.97	50.14
STATION=BC02 YEAR=79 MONTH=1							
SND	2	51.30	18.53	38.20	64.40	343.22	36.11
SNM	2	8.10	2.40	6.40	9.80	5.78	29.68
STATION=BC02 YEAR=79 MONTH=2							
SND	1	33.20	.	33.20	33.20	.	.
SNM	1	8.20	.	8.20	8.20	.	.
STATION=BC02 YEAR=79 MONTH=3							
SND	2	31.00	16.97	19.00	43.00	288.00	54.74
SNM	2	8.00	3.39	5.60	10.40	11.52	42.43
STATION=BC02 YEAR=79 MONTH=4							
SND	1	4.00	.	4.00	4.00	.	.
SNM	0	.	.	.	.	.	.
STATION=BC02 YEAR=79 MONTH=11							
SND	2	4.10	5.80	0	8.20	33.62	141.42
SNM	2	0.80	1.13	0	1.60	1.28	141.42
STATION=BC02 YEAR=79 MONTH=12							
SND	2	23.40	3.39	21.00	25.80	11.52	14.50
SNM	2	4.40	0.28	4.20	4.60	0.08	6.43
STATION=BC02 YEAR=80 MONTH=1							
SND	1	27.60	.	27.60	27.60	.	.
SNM	1	3.60	.	3.60	3.60	.	.
STATION=BC02 YEAR=80 MONTH=2							
SND	2	23.80	1.13	23.00	24.60	1.28	4.75
SNM	2	6.70	0.42	6.40	7.00	0.18	6.33
STATION=BC02 YEAR=80 MONTH=3							
SND	2	5.50	0.42	5.20	5.80	0.18	7.71
SNM	2	1.40	0.28	1.20	1.60	0.08	20.20

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS
STATION=BC02 YEAR=82 MONTH=2

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC02 YEAR=80 MONTH=12							
SND	2	0.40	0.57	0	0.80	0.32	141.42
SNM	2	0.10	0.14	0	0.20	0.02	141.42
STATION=BC02 YEAR=81 MONTH=1							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC02 YEAR=81 MONTH=2							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC02 YEAR=81 MONTH=3							
SND	2	4.65	6.58	0	9.30	43.24	141.42
SNM	2	0.85	1.20	0	1.70	1.44	141.42
STATION=BC02 YEAR=81 MONTH=11							
SND	2	7.85	5.02	4.30	11.40	25.21	63.95
SNM	1	2.00	.	2.00	2.00	.	.
STATION=BC02 YEAR=82 MONTH=1							
SND	1	24.40	.	24.40	24.40	.	.
SNM	1	5.60	.	5.60	5.60	.	.
STATION=BC02 YEAR=82 MONTH=2							
SND	1	17.00	.	17.00	17.00	.	.
SNM	1	4.60	.	4.60	4.60	.	.

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC03 YEAR=78 MONTH=12							
SND	3	25.17	7.03	17.10	30.00	49.44	27.94
SNM	3	3.07	1.33	1.60	4.20	1.77	43.42
STATION=BC03 YEAR=79 MONTH=1							
SND	2	43.40	12.16	34.80	52.00	147.92	28.02
SNM	2	8.50	3.82	5.80	11.20	14.58	44.92
STATION=BC03 YEAR=79 MONTH=2							
SND	1	41.40	.	41.40	41.40	.	.
SNM	1	8.60	.	8.60	8.60	.	.
STATION=BC03 YEAR=79 MONTH=3							
SND	2	46.40	7.64	41.00	51.80	58.32	16.46
SNM	2	11.70	1.84	10.40	13.00	3.38	15.71
STATION=BC03 YEAR=79 MONTH=4							
SND	1	37.60	.	37.60	37.60	.	.
SNM	1	9.40	.	9.40	9.40	.	.
STATION=BC03 YEAR=79 MONTH=11							
SND	2	5.00	7.07	0	10.00	50.00	141.42
SNM	2	1.00	1.41	0	2.00	2.00	141.42
STATION=BC03 YEAR=79 MONTH=12							
SND	2	24.50	0.42	24.20	24.80	0.18	1.73
SNM	2	5.40	0.00	5.40	5.40	0.00	0.00
STATION=BC03 YEAR=80 MONTH=1							
SND	1	32.70	.	32.70	32.70	.	.
SNM	1	3.80	.	3.80	3.80	.	.
STATION=BC03 YEAR=80 MONTH=2							
SND	2	29.20	0.57	28.80	29.60	0.32	1.94
SNM	2	6.30	0.14	6.20	6.40	0.02	2.24
STATION=BC03 YEAR=80 MONTH=3							
SND	2	30.20	4.53	27.00	33.40	20.48	14.99
SNM	2	9.50	0.71	9.00	10.00	0.50	7.44

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC03 YEAR=80 MONTH=12							
SND	2	0.40	0.57	0	0.80	0.32	141.42
SNM	2	0.00	0.00	0	0.00	0.00	.
STATION=BC03 YEAR=81 MONTH=1							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC03 YEAR=81 MONTH=2							
SND	2	4.90	6.93	0	9.80	48.02	141.42
SNM	2	1.10	1.56	0	2.20	2.42	141.42
STATION=BC03 YEAR=81 MONTH=3							
SND	2	6.60	9.33	0	13.20	87.12	141.42
SNM	2	1.00	1.41	0	2.00	2.00	141.42
STATION=BC03 YEAR=81 MONTH=11							
SND	2	8.65	6.15	4.30	13.00	37.85	71.12
SNM	1	1.80	.	1.80	1.80	.	.
STATION=BC03 YEAR=82 MONTH=1							
SND	1	20.00	.	20.00	20.00	.	.
SNM	1	4.40	.	4.40	4.40	.	.
STATION=BC03 YEAR=82 MONTH=2							
SND	2	24.50	10.61	17.00	32.00	112.50	43.29
SNM	2	5.40	0.28	5.20	5.60	0.08	5.24

*
SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE*	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC04 YEAR=78 MONTH=12							
SND	3	29.10	6.37	21.80	33.50	40.53	21.88
SNM	3	4.53	1.36	3.00	5.60	1.85	30.03
STATION=BC04 YEAR=79 MONTH=1							
SND	2	44.20	5.94	40.00	48.40	35.28	13.44
SNM	2	6.80	3.11	4.60	9.00	9.68	45.75
STATION=BC04 YEAR=79 MONTH=2							
SND	1	33.80	.	33.80	33.80	.	.
SNM	1	7.40	.	7.40	7.40	.	.
STATION=BC04 YEAR=79 MONTH=3							
SND	2	19.00	23.48	2.40	35.60	551.12	123.56
SNM	2	6.20	7.64	0.80	11.60	58.32	123.17
STATION=BC04 YEAR=79 MONTH=4							
SND	1	3.00	.	3.00	3.00	.	.
SNM	0	.	.	.	.	.	.
STATION=BC04 YEAR=79 MONTH=11							
SND	2	5.00	7.07	0	10.00	50.00	141.42
SNM	2	1.40	1.98	0	2.80	3.92	141.42
STATION=BC04 YEAR=79 MONTH=12							
SND	2	20.60	3.39	18.20	23.00	11.52	16.48
SNM	2	4.40	0.28	4.20	4.60	0.08	6.43
STATION=BC04 YEAR=80 MONTH=2							
SND	2	26.60	8.77	20.40	32.80	76.88	32.96
SNM	2	6.30	1.27	5.40	7.20	1.62	20.20
STATION=BC04 YEAR=80 MONTH=3							
SND	2	4.60	3.68	2.00	7.20	13.52	79.93
SNM	2	1.50	1.56	0.40	2.60	2.42	103.71

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
			STATION=BC04	YEAR=80	MONTH=12		
SND	2	0.80	1.13	0	1.60	1.28	141.42
SNM	2	0.20	0.28	0	0.40	0.08	141.42
			STATION=BC04	YEAR=81	MONTH=1		
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
			STATION=BC04	YEAR=81	MONTH=2		
SND	2	1.60	2.26	0	3.20	5.12	141.42
SNM	2	0.30	0.42	0	0.60	0.18	141.42
			STATION=BC04	YEAR=81	MONTH=3		
SND	2	4.40	6.22	0	8.80	38.72	141.42
SNM	2	0.80	1.13	0	1.60	1.28	141.42
			STATION=BC04	YEAR=81	MONTH=11		
SND	2	9.90	1.27	9.00	10.80	1.62	12.86
SNM	1	2.00	.	2.00	2.00	.	.
			STATION=BC04	YEAR=82	MONTH=1		
SND	1	26.80	.	26.80	26.80	.	.
SNM	1	5.20	.	5.20	5.20	.	.
			STATION=BC04	YEAR=82	MONTH=2		
SND	2	20.95	0.64	20.50	21.40	0.40	3.04
SNM	2	5.15	3.04	3.00	7.30	9.24	59.04

*
SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC05 YEAR=78 MONTH=12							
SND	3	20.57	3.62	16.40	22.90	13.08	17.59
SNM	3	3.70	1.15	2.50	4.80	1.33	31.17
STATION=BC05 YEAR=79 MONTH=1							
SND	2	35.80	5.94	31.60	40.00	35.28	16.59
SNM	2	6.00	1.13	5.20	6.80	1.28	18.86
STATION=BC05 YEAR=79 MONTH=2							
SND	1	25.60	.	25.60	25.60	.	.
SNM	1	4.40	.	4.40	4.40	.	.
STATION=BC05 YEAR=79 MONTH=3							
SND	2	20.10	16.83	8.20	32.00	283.22	83.73
SNM	2	5.60	4.53	2.40	8.80	20.48	80.81
STATION=BC05 YEAR=79 MONTH=4							
SND	1	9.40	.	9.40	9.40	.	.
SNM	0	.	.	.	.	.	.
STATION=BC05 YEAR=79 MONTH=11							
SND	2	2.40	3.39	0	4.80	11.52	141.42
SNM	2	0.40	0.57	0	0.80	0.32	141.42
STATION=BC05 YEAR=79 MONTH=12							
SND	2	14.30	0.14	14.20	14.40	0.02	0.99
SNM	2	3.20	0.28	3.00	3.40	0.08	8.84
STATION=BC05 YEAR=80 MONTH=1							
SND	1	16.80	.	16.80	16.80	.	.
SNM	1	1.80	.	1.80	1.80	.	.
STATION=BC05 YEAR=80 MONTH=2							
SND	2	17.10	0.42	16.80	17.40	0.18	2.48
SNM	2	3.60	0.28	3.40	3.80	0.08	7.86
STATION=BC05 YEAR=80 MONTH=3							
SND	2	13.80	1.41	12.80	14.80	2.00	10.25
SNM	2	4.40	0.85	3.80	5.00	0.72	19.28

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC05 YEAR=80 MONTH=12							
SND	2	0.20	0.28	0	0.40	0.08	141.42
SNM	2	0.00	0.00	0	0.00	0.00	.
STATION=BC05 YEAR=81 MONTH=1							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC05 YEAR=81 MONTH=2							
SND	2	2.90	4.10	0	5.80	16.82	141.42
SNM	2	0.60	0.85	0	1.20	0.72	141.42
STATION=BC05 YEAR=81 MONTH=3							
SND	2	3.65	5.16	0	7.30	26.64	141.42
SNM	2	0.85	1.20	0	1.70	1.44	141.42
STATION=BC05 YEAR=81 MONTH=11							
SND	2	5.90	1.27	5.00	6.80	1.62	21.57
SNM	1	2.00	.	2.00	2.00	.	.
STATION=BC05 YEAR=82 MONTH=1							
SND	1	15.20	.	15.20	15.20	.	.
SNM	1	2.00	.	2.00	2.00	.	.
STATION=BC05 YEAR=82 MONTH=2							
SND	2	24.40	5.09	20.80	28.00	25.92	20.87
SNM	2	5.05	2.05	3.60	6.50	4.21	40.61

*
SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC06 YEAR=78 MONTH=12							
SND	3	33.30	3.38	30.20	36.90	11.41	10.14
SNM	3	3.67	1.10	2.60	4.80	1.21	30.04
STATION=BC06 YEAR=79 MONTH=1							
SND	2	48.10	8.91	41.80	54.40	79.38	18.52
SNM	2	8.10	2.97	6.00	10.20	8.82	36.66
STATION=BC06 YEAR=79 MONTH=2							
SND	1	41.20	.	41.20	41.20	.	.
SNM	1	7.80	.	7.80	7.80	.	.
STATION=BC06 YEAR=79 MONTH=3							
SND	1	51.20	.	51.20	51.20	.	.
SNM	1	12.60	.	12.60	12.60	.	.
STATION=BC06 YEAR=79 MONTH=4							
SND	1	30.40	.	30.40	30.40	.	.
SNM	1	8.30	.	8.30	8.30	.	.
STATION=BC06 YEAR=79 MONTH=11							
SND	2	2.80	3.39	0.40	5.20	11.52	121.22
SNM	2	0.80	0.28	0.60	1.00	0.08	35.36
STATION=BC06 YEAR=79 MONTH=12							
SND	2	21.90	2.69	20.00	23.80	7.22	12.27
SNM	2	4.30	0.14	4.20	4.40	0.02	3.29
STATION=BC06 YEAR=80 MONTH=1							
SND	1	30.60	.	30.60	30.60	.	.
SNM	1	3.80	.	3.80	3.80	.	.
STATION=BC06 YEAR=80 MONTH=2							
SND	2	34.00	1.70	32.80	35.20	2.88	4.99
SNM	2	8.20	0.85	7.60	8.80	0.72	10.35
STATION=BC06 YEAR=80 MONTH=3							
SND	2	28.90	0.14	28.80	29.00	0.02	0.49
SNM	2	9.40	0.28	9.20	9.60	0.08	3.01

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC06 YEAR=80 MONTH=12							
SND	2	0.80	1.13	0	1.60	1.28	141.42
SNM	2	0.00	0.00	0	0.00	0.00	.
STATION=BC06 YEAR=81 MONTH=1							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC06 YEAR=81 MONTH=2							
SND	2	4.70	6.65	0	9.40	44.18	141.42
SNM	2	1.00	1.41	0	2.00	2.00	141.42
STATION=BC06 YEAR=81 MONTH=3							
SND	2	5.00	7.07	0	10.00	50.00	141.42
SNM	2	0.50	0.71	0	1.00	0.50	141.42
STATION=BC06 YEAR=81 MONTH=11							
SND	2	7.63	3.36	5.25	10.00	11.28	44.05
SNM	1	8.00	.	8.00	8.00	.	.
STATION=BC06 YEAR=82 MONTH=1							
SND	1	26.60	.	26.60	26.60	.	.
SNM	1	6.40	.	6.40	6.40	.	.
STATION=BC06 YEAR=82 MONTH=2							
SND	2	30.40	8.49	24.40	36.40	72.00	27.91
SNM	2	5.40	0.00	5.40	5.40	0.00	0.00

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0 in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
			STATION=BC07	YEAR=78	MONTH=12		
SND	3	24.30	11.05	13.10	35.20	122.17	45.49
SNM	3	3.73	0.83	2.80	4.40	0.69	22.30
			STATION=BC07	YEAR=79	MONTH=1		
SND	2	40.10	11.17	32.20	48.00	124.82	27.86
SNM	2	7.40	3.96	4.60	10.20	15.68	53.51
			STATION=BC07	YEAR=79	MONTH=2		
SND	1	29.40	.	29.40	29.40	.	.
SNM	1	6.20	.	6.20	6.20	.	.
			STATION=BC07	YEAR=79	MONTH=3		
SND	2	24.70	19.37	11.00	38.40	375.38	78.44
SNM	2	5.50	4.95	2.00	9.00	24.50	90.00
			STATION=BC07	YEAR=79	MONTH=4		
SND	1	3.00	.	3.00	3.00	.	.
SNM	0	.	.	.	.	.	.
			STATION=BC07	YEAR=79	MONTH=11		
SND	2	6.10	8.63	0	12.20	74.42	141.42
SNM	2	1.10	1.56	0	2.20	2.42	141.42
			STATION=BC07	YEAR=79	MONTH=12		
SND	2	22.40	0.28	22.20	22.60	0.08	1.26
SNM	2	5.10	0.42	4.80	5.40	0.18	8.32
			STATION=BC07	YEAR=80	MONTH=1		
SND	1	30.80	.	30.80	30.80	.	.
SNM	1	5.80	.	5.80	5.80	.	.
			STATION=BC07	YEAR=80	MONTH=2		
SND	2	25.10	1.56	24.00	26.20	2.42	6.20
SNM	2	6.30	1.27	5.40	7.20	1.62	20.20
			STATION=BC07	YEAR=80	MONTH=3		
SND	2	18.40	2.83	16.40	20.40	8.00	15.37
SNM	2	5.40	0.00	5.40	5.40	0.00	0.00

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC07 YEAR=80 MONTH=12							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC07 YEAR=81 MONTH=1							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC07 YEAR=81 MONTH=2							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC07 YEAR=81 MONTH=3							
SND	2	3.80	5.37	0	7.60	28.88	141.42
SNM	2	1.10	1.56	0	2.20	2.42	141.42
STATION=BC07 YEAR=81 MONTH=11							
SND	2	9.25	3.89	6.50	12.00	15.13	42.04
SNM	1	3.00	.	3.00	3.00	.	.
STATION=BC07 YEAR=82 MONTH=1							
SND	1	22.00	.	22.00	22.00	.	.
SNM	1	3.40	.	3.40	3.40	.	.
STATION=BC07 YEAR=82 MONTH=2							
SND	2	22.50	7.21	17.40	27.60	52.02	32.06
SNM	2	5.10	0.14	5.00	5.20	0.02	2.77

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=HC08		YEAR=78		MONTH=12			
SND	3	8.53	7.83	0	15.40	61.37	91.81
SNM	3	1.00	1.00	0	2.00	1.00	100.00
STATION=HC08		YEAR=79		MONTH=1			
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC08		YEAR=79		MONTH=2			
SND	1	0	.	0	0	.	.
SNM	1	0	.	0	0	.	.
STATION=BC08		YEAR=79		MONTH=3			
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=HC08		YEAR=79		MONTH=4			
SND	1	3.20	.	3.20	3.20	.	.
SNM	0	.	.	.	.	.	.
STATION=HC08		YEAR=79		MONTH=11			
SND	1	0	.	0	0	.	.
SNM	1	0	.	0	0	.	.
STATION=HC08		YEAR=79		MONTH=12			
SND	2	1.80	2.55	0	3.60	6.48	141.42
SNM	2	0.70	0.99	0	1.40	0.98	141.42
STATION=HC08		YEAR=80		MONTH=2			
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=HC08		YEAR=80		MONTH=3			
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC08 YEAR=80 MONTH=12							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC08 YEAR=81 MONTH=1							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC08 YEAR=81 MONTH=2							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC08 YEAR=81 MONTH=3							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC08 YEAR=82 MONTH=1							
SND	1	0	.	0	0	.	.
SNM	1	0	.	0	0	.	.
STATION=BC08 YEAR=82 MONTH=2							
SND	2	3.80	5.37	0	7.60	28.88	141.42
SNM	2	0.20	0.28	0	0.40	0.08	141.42

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC09 YEAR=78 MONTH=12							
SND	3	22.37	5.47	16.10	26.20	29.94	24.47
SNM	3	3.60	1.83	1.60	5.20	3.36	50.92
STATION=BC09 YEAR=79 MONTH=1							
SND	2	38.30	9.19	31.80	44.80	84.50	24.00
SNM	2	5.50	1.27	4.60	6.40	1.62	23.14
STATION=BC09 YEAR=79 MONTH=2							
SND	1	24.60	.	24.60	24.60	.	.
SNM	1	5.20	.	5.20	5.20	.	.
STATION=BC09 YEAR=79 MONTH=3							
SND	2	19.00	16.12	7.60	30.40	259.92	84.85
SNM	2	4.70	4.10	1.80	7.60	16.82	87.26
STATION=BC09 YEAR=79 MONTH=4							
SND	1	2.60	.	2.60	2.60	.	.
SNM	0	.	.	.	.	.	.
STATION=BC09 YEAR=79 MONTH=11							
SND	2	4.30	6.08	0	8.60	36.98	141.42
SNM	2	0.90	1.27	0	1.80	1.62	141.42
STATION=BC09 YEAR=79 MONTH=12							
SND	2	21.50	1.84	20.20	22.80	3.38	8.55
SNM	2	3.50	0.99	2.80	4.20	0.98	28.28
STATION=BC09 YEAR=80 MONTH=1							
SND	1	28.80	.	28.80	28.80	.	.
SNM	1	3.80	.	3.80	3.80	.	.
STATION=BC09 YEAR=80 MONTH=2							
SND	2	23.60	5.66	19.60	27.60	32.00	23.97
SNM	2	5.20	1.70	4.00	6.40	2.88	32.64
STATION=BC09 YEAR=80 MONTH=3							
SND	2	5.60	3.39	3.20	8.00	11.52	60.61
SNM	2	1.70	0.99	1.00	2.40	0.98	58.23

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC09 YEAR=80 MONTH=12							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC09 YEAR=81 MONTH=1							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC09 YEAR=81 MONTH=2							
SND	2	0	0	0	0	0	.
SNM	2	0	0	0	0	0	.
STATION=BC09 YEAR=81 MONTH=3							
SND	2	2.35	3.32	0	4.70	11.04	141.42
SNM	2	0.65	0.92	0	1.30	0.84	141.42
STATION=BC09 YEAR=81 MONTH=11							
SND	2	6.85	3.32	4.50	9.20	11.04	48.52
SNM	1	1.40	.	1.40	1.40	.	.
STATION=BC09 YEAR=82 MONTH=1							
SND	1	15.20	.	15.20	15.20	.	.
SNM	1	3.20	.	3.20	3.20	.	.
STATION=BC09 YEAR=82 MONTH=2							
SND	2	16.85	5.02	13.30	20.40	25.20	29.79
SNM	2	4.10	0.99	3.40	4.80	0.98	24.15

*
SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
			STATION=BC13	YEAR=78	MONTH=12		
SND	3	40.43	4.10	36.00	44.10	16.84	10.15
SNM	3	4.07	0.81	3.20	4.80	0.65	19.88
			STATION=BC13	YEAR=79	MONTH=1		
SND	2	59.00	8.20	53.20	64.80	67.28	13.90
SNM	2	8.90	5.23	5.20	12.60	27.38	58.79
			STATION=BC13	YEAR=79	MONTH=2		
SND	1	52.20	.	52.20	52.20	.	.
SNM	1	12.00	.	12.00	12.00	.	.
			STATION=BC13	YEAR=79	MONTH=3		
SND	2	55.10	14.28	45.00	65.20	204.02	25.92
SNM	2	13.20	1.98	11.80	14.60	3.92	15.00
			STATION=BC13	YEAR=79	MONTH=4		
SND	1	51.60	.	51.60	51.60	.	.
SNM	1	9.40	.	9.40	9.40	.	.
			STATION=BC13	YEAR=79	MONTH=11		
SND	2	10.30	7.50	5.00	15.60	56.18	72.77
SNM	2	1.50	0.14	1.40	1.60	0.02	9.43
			STATION=BC13	YEAR=79	MONTH=12		
SND	2	33.60	4.53	30.40	36.80	20.48	13.47
SNM	2	5.80	0.28	5.60	6.00	0.08	4.88
			STATION=BC13	YEAR=80	MONTH=1		
SND	1	38.80	.	38.80	38.80	.	.
SNM	1	4.60	.	4.60	4.60	.	.
			STATION=BC13	YEAR=80	MONTH=2		
SND	2	53.30	3.25	51.00	55.60	10.58	6.10
SNM	2	11.20	1.13	10.40	12.00	1.28	10.10
			STATION=BC13	YEAR=80	MONTH=3		
SND	2	53.60	2.83	51.60	55.60	8.00	5.28
SNM	2	13.70	1.56	12.60	14.80	2.42	11.35

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

MONTHLY SNOW DEPTH AND SNOW MOISTURE STATISTICS

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
STATION=BC13 YEAR=80 MONTH=12							
SND	2	5.40	1.70	4.20	6.60	2.88	31.43
SNM	2	0.50	0.42	0.20	0.80	0.18	84.85
STATION=BC13 YEAR=81 MONTH=1							
SND	2	6.80	9.62	0	13.60	92.48	141.42
SNM	2	1.30	1.84	0	2.60	3.38	141.42
STATION=BC13 YEAR=81 MONTH=2							
SND	2	11.90	16.83	0	23.80	283.22	141.42
SNM	2	2.00	2.83	0	4.00	8.00	141.42
STATION=BC13 YEAR=81 MONTH=3							
SND	2	10.30	10.61	2.80	17.80	112.50	102.98
SNM	2	2.00	1.70	0.80	3.20	2.88	84.85
STATION=BC13 YEAR=81 MONTH=11							
SND	2	13.30	0.14	13.20	13.40	0.02	1.06
SNM	1	1.80	.	1.80	1.80	.	.
STATION=BC13 YEAR=82 MONTH=1							
SND	1	42.00	.	42.00	42.00	.	.
SNM	1	4.60	.	4.60	4.60	.	.
STATION=BC13 YEAR=82 MONTH=2							
SND	2	49.00	9.90	42.00	56.00	98.00	20.20
SNM	2	8.40	2.55	6.60	10.20	6.48	30.30
STATION=BC13 YEAR=82 MONTH=3							
SND	2	21.70	14.28	11.60	31.80	204.02	65.82
SNM	2	5.10	3.54	2.60	7.60	12.50	69.32

*

SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

TWO-YEAR SUMMARY OF SNOW DEPTH AND SNOW MOISTURE STATISTICS

12/1/78 - 11/30/80

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
SND	177	23.91	16.16	0	65.20	261.06	67.59
SNM	170	4.89	3.47	0	14.80	12.06	71.06

12/1/80 - 8/31/82

VARIABLE *	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	VARIANCE	C.V.
SND	128	7.83	10.83	0	56.00	117.23	138.21
SNM	118	1.62	2.30	0	10.20	5.30	141.69

* SND = Snow Depth (cm)
SNM = Snow Moisture (cm)

Metric Conversion Factor = 2.54cm = 1.0in.

TRAFFIC LOAD

3.2 Traffic Load

This section contains vehicular and passenger load data along Piceance Creek road and into the C-b Oil Shale Tract.

Daily incoming vehicle counts taken at the C-b Guard Shack are presented in Table 3.2-1. These data are delineated into counts of cars and trucks from January 1982 to December 1982.

The C-b Shale Oil Project provided regular bus service for employees to and from the C-b Tract from April 1, 1978 to October 23, 1982. Table 3.2-2 summarizes bus passenger miles data for January through October 1982.

A program of monitoring vehicular traffic was initiated in March, 1978. Counters were placed at three stations:

1. BT01 - Rio Blanco Store.
2. BT02 - Cattleguard on CB access road.
3. BT03 - Rio Blanco Lake on Piceance Creek Road.

These data are recorded on paper tape, therefore vehicle type (i.e. car or truck) is unknown. Data are collected for a one-week interval once a month. Table 3.2-3 presents a summary of the traffic data collected at the three stations for June through December 1982.

TABLE 3.2-1

CATHEDRAL BLUFFS GUARD SHACK DAILY TRAFFIC COUNT - 1982

MONTH	DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
January	Car	15	13	30	123	109	89	102	116	28	25	113	87	97	99	97	31	43	108	126	92	94	90	34	25	139	133	113	121	95	30	19
	Truck	0	0	0	11	5	6	3	3	0	0	3	5	4	5	6	0	0	4	5	2	7	4	2	0	3	3	4	9	4	0	0
February	Car	131	98	94	85	94	23	21	69	79	87	116	95	29	20	79	82	89	101	78	32	17	90	112	87	88	106	32	27	-	-	-
	Truck	2	7	7	6	5	0	0	8	5	10	10	3	1	0	2	8	1	13	7	1	0	4	9	3	3	0	0	0	-	-	-
March	Car	74	68	97	79	69	43	23	42	75	77	89	78	17	12	68	69	59	89	61	15	32	70	105	57	63	94	29	21	78	71	97
	Truck	7	11	8	4	3	0	0	4	7	3	5	5	0	5	0	5	1	4	4	0	0	5	7	5	4	7	0	0	2	3	5
April	Car	61	55	22	22	46	69	66	67	31	15	11	70	80	82	84	64	13	7	61	79	70	78	70	19	18	80	58	84	74	73	
	Truck	2	2	0	0	5	0	0	5	0	0	0	7	5	5	5	3	2	0	4	3	4	3	0	0	0	4	5	0	0	1	
May	Car	13	11	72	77	74	76	68	10	6	72	71	46	58	57	6	15	68	57	64	49	58	6	6	64	62	76	71	30	8	6	8
	Truck	0	0	5	5	3	3	4	0	0	2	1	0	2	2	0	0	2	0	4	6	0	0	0	0	0	1	2	1	0	0	0
June	Car	62	53	37	51	6	5	70	49	65	53	56	9	14	67	68	55	66	62	19	10	64	51	64	63	48	6	13	62	57	66	-
	Truck	4	3	0	4	0	0	3	1	2	5	3	0	0	3	3	3	4	2	0	0	1	3	1	0	1	0	0	2	3	3	-
July	Car	55	48	8	11	14	66	66	63	57	13	15	66	64	84	60	62	18	11	52	61	56	64	29	27	16	68	64	47	74	64	40
	Truck	0	0	0	1	0	3	2	1	3	2	0	2	4	6	0	0	0	0	3	0	0	2	3	0	0	6	1	1	2	2	0
August	Car	37	51	60	56	59	55	49	9	54	59	49	52	55	39	33	53	55	49	75	54	36	34	54	53	60	59	53	17	16	41	45
	Truck	1	5	3	2	2	1	0	0	1	3	3	0	1	0	0	0	0	0	2	1	0	0	1	0	1	2	0	0	1	2	2
September	Car	45	60	51	12	27	18	40	56	49	41	16	11	44	43	44	41	36	17	17	38	41	45	62	50	19	7	43	41	35	38	-
	Truck	1	2	1	0	1	0	2	0	2	0	0	0	3	0	6	1	1	0	0	5	1	1	4	3	0	0	1	1	2	2	-
October	Car	37	14	8	40	48	49	34	31	10	9	43	46	41	43	38	10	8	27	24	29	44	17	8	6	45	35	37	41	32	14	16
	Truck	0	0	0	1	4	6	2	4	0	0	0	3	0	3	0	0	0	2	1	0	0	1	0	0	1	2	2	2	1	0	0
November	Car	48	41	40	41	27	7	10	39	35	34	34	24	10	7	36	36	39	43	38	19	21	31	31	37	7	20	15	21	51	44	-
	Truck	1	0	1	2	0	0	0	1	1	1	2	2	0	0	2	4	0	3	1	0	0	2	0	1	0	1	0	0	1	1	-
December	Car	39	59	46	10	13	40	45	37	33	28	21	21	35	32	29	38	36	20	24	32	33	29	21	7	6	6	23	18	18	14	6
	Truck	0	2	1	0	0	3	1	3	2	1	0	1	2	1	1	0	2	0	0	2	4	1	1	0	0	0	1	2	2	1	0

TABLE 3.2-2

1982 MONTHLY BUS STATISTICS FOR CB

Month	Round Trip CB-Rifle	Round Trip CB-Meeker	Round Trip Passengers Rifle	Round Trip Passengers Meeker	Average Passengers/Trip* Rifle	Average Passengers/Trip* Meeker
June	112	112	774	1005	6.9	9.0
July	54	54	521	666	9.7	12.3
August	22	22	457	508	20.8	23.1
Sept.	21	21	357	264	17.0	12.6
Oct.	16	16	210	119	13.1	7.4
Nov.	**					
Dec.						

*   Bus capacity is 47.
** Bussing program discontinued 10/23/82.

TABLE 3.2-3
C-B STEVENS RECORDER TRAFFIC COUNT

JUNE 1982 - DECEMBER 1982

			LOCATION BT01		BT02		BT03	
YEAR	MONTH	DAY	IN TRAFFIC	OUT TRAFFIC	IN TRAFFIC	OUT TRAFFIC	IN TRAFFIC	OUT TRAFFIC
82	6	1			330	101	155	144
		2			150	57	74	113
		21			262	8	16	36
		22	123	136			117	134
		23	158	176			146	124
		24	153	193			147	137
		25	107	53			151	157
		26					127	106
		27					93	104
		28					121	81
	7	8			27	13		
	8	2	48	84	27	62	22	30
		3	150	145	80	82	111	121
		4	137	157	98	104	126	105
		5	140	154	95	93	105	105
		6	127	129	70	69	101	103
		7	108	106	49	57	64	101
		8	97	78			74	70
		9	151	128			75	68
		10	49	5				
		26			66	88	75	93
		27			80	83	81	73
		28			26	27	65	72
		29			31	32	55	53
		30			64	73	113	98
		31			70	68	84	85
	9	1			65	30	56	50
		20			9	3	17	15
		21	55	112	75	75	105	100
		22	139	128	73	76	108	123
		23	152	151	86	85	112	105
		24	175	177	77	81	102	109
		25	107	124	34	33	78	83
		26	101	110	22	20	67	67
		27	165	175	61	56	118	116
		28	169	169	55	57	121	148
		29	77	33	51	56	175	161
		30			5	19	12	8
	11	4	94	122	2	13	29	36
		5	484	272	3	54	190	188
		6	305	267	2	14	162	147

TABLE 3.2-3 (Contd)

C-B STEVENS RECORDER TRAFFIC COUNT

JUNE 1982 - DECEMBER 1982

			LOCATION BT01		BT02		BT03	
YEAR	MONTH	DAY	IN TRAFFIC	OUT TRAFFIC	IN TRAFFIC	OUT TRAFFIC	IN TRAFFIC	OUT TRAFFIC
82	11	7	347	347	7	19	174	197
		8	333	402	3	2	222	230
		9	317	379			239	251
		10	240	386			215	215
		11	277	236			114	125
		12	187	205			77	99
		13	161	160			73	69
		14	137	135			73	75
		15	176	165			74	91
		16	190	193			72	94
		17	189	177			96	128
		18	153	66			95	107
		19					16	2
	12	10	17	26	4	15	13	23
		11	113	95	43	32	76	103
		12	106	92	32	26	80	93
		13	147	89	73	54	70	76
		14	119	80	66	49	66	67
		15	143	104	62	50	79	85
		16	109	102	57	42	71	71
		17	128	128	63	55	80	72
		18	80	91	34	24	53	58
		19	81	77	46	29	40	57
		20	94	107	44	36	60	47
		21	70	58				
TOTAL			7485	7284	2679	2122	5978	6204

4.0 Data Automation

The enviromental data base at present is partially manual and partially computerized. For purposes of analysis, data specificity, data security, and data archiving, the data base is being further computerized. It is the intent that all "indicator variables" be entered into RAMIS (Rapid Access Management Information System). Toward this end computer codes have been designated for all environmental station locations.

This section presents the status of automated data base, station location data, and a cross-reference list of four-digit computer codes and station monitoring codes.

AUTOMATION
STATUS

4.1 Automation Status

This section presents the status of the automated data base for the C-b Tract environmental data stored on the Occidental Petroleum Corporation computer system in Houston, Texas.

RAMIS II is a computerized data base management system (DBMS) used by the C-b Shale Oil Project via the Occidental Computer Center in Houston, Texas. C-b Shale Oil Tract environmental data are entered into RAMIS DBMS as a means of making relevant data available for subsequent retrievals for use in reports and impact analyses. The use of this system provides an economical way to store and retrieve selected data in formats desired for reports and for input to analytic models requiring the data. Data are also archived within this system and through magnetic tapes containing the source raw data.

The following environmental data are entered into RAMIS DBMS:

Water Quality	
Springs and Seeps	October 1974 thru November 1981
Alluvial Wells	October 1974 thru November 1981
Deep Bedrock Wells	October 1974 thru December 1982
Field Measurements	
Springs and Seeps	October 1974 thru December 1982
Alluvial Wells	October 1974 thru December 1982
Deep Bedrock Wells	October 1974 thru December 1982
Levels and Flows	
Well Levels	October 1974 thru December 1982
Spring Flows	October 1974 thru December 1982
Water Augmentation Plan	
Springs and Seeps	July 1979 thru October 1982
Deep Bedrock Wells	August 1979 thru October 1982
Precipitation	January 1979 thru April 1982
National Pollutant Discharge Elimination System	
Water Quality Data	July 1979 thru December 1982
Water Usage	June 1980 thru December 1982
Well Reinjection	March 1981 thru June 1982 (Discontinued)
Air Quality & Meteorology	
Weather Stations (Station AD42)	October 1974 thru March 1982
(Station AD56)	October 1974 thru August 1980
(Station AD20)	February 1982 thru July 1982

4.1 Automation Status (Continued)

Air Quality & Meteorology (Continued)

Large Trailer (Station AB20)	October 1974 thru January 1982 (Discontinued)
Large Trailer (Station AB23)	October 1974 thru December 1982
Large Trailer (Station AB26)	October 1981 thru March 1982
Meteorological Tower (Station AA23)	October 1974 thru December 1982
Traffic	February 1980 thru December 1982
Biology	
Microclimate	October 1974 thru December 1982
Deer Kill	October 1977 thru December 1982
Deer Count	Sept. 1977 thru December 1982
Avifauna	1977 thru 1981

The status of the files are shown in Figures 4.1-1 through 4.1-9. File descriptions for the 22 files that reside in the RAMIS data base are shown in Tables 4.1-1 through 4.1-4.

Data collected and analyzed by USGS for stream flow and stream water quality are stored in government computer data bases in Reston, Virginia. These data bases (WATSTOR) and (NAWDEX) are accessed by dialing computer communications for retrievals of data to the Grand Junction computers for printing and analyses.

AUTOMATION STATUS
LIST OF TABLES & FIGURES

* These files contain data for studies which have been discontinued.

FIGURE 4.1-1

WATER QUALITY - UPPER AQUIFER WELLS
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YR 82 MO 8	11	12
WX32		X	
WX44	X		X

WATER QUALITY - LOWER AQUIFER WELLS
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YR 82 MO 8	12
WY45	X	X
WY81	X	

WATER QUALITY - BEDROCK WELLS
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YR 82 MO 8	9	11	12
WD12			X	
WD20				X
WD57			X	
WD90	X		X	
WE20				X
WG12			X	
WG20		X		

WC = UINTAH
WD = UPC1
WE = UPC2
WG = UPC3
WH = UPC4

FIGURE 4.1-1 (Contd)

WATER QUALITY - INJECTION WELLS
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YR 82 MO 6
WI18	X

WATER QUALITY - SEEPAGE MONITORING WELLS
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YR 82 MO 6	8	9	10	11	12
WW13	X	X				
WW22	X	X	X	X	X	X
WW32	X		X			

FIGURE 4.1-2

WATER QUALITY - DISCHARGE STATIONS
SAMPLING TIME INTERVAL
DATABASE STATUS

	YEAR 82 MONTH 7	8	9	10	11	12
COMPUTER CODE						
WN40	X	X	X	X	X	X
WN41	X	X	X	X	X	X
WN42	X	X	X	X	X	X
WU02	X	X	X	X	X	X

WATER QUALITY - DISCHARGE STATIONS
QUARTERLY SAMPLING INTERVAL
DATABASE STATUS

	YR 82 MO 7	10
COMPUTER CODE		
WN40	X	X

FIGURE 4.1.3

SPRINGS - FLOW
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YR 82 MO 6	7	8	9	10	11	12
WS01						X	X
WS02					X	X	X
WS03						X	X
WS04	X	X	X	X	X	X	X
WS06	X	X	X	X	X	X	X
WS07	X	X	X	X	X	X	X
WS08					X	X	X
WS09					X	X	X
WS10					X	X	X
WS11	X	X		X	X	X	X
WS12	X	X	X	X	X	X	X
WS21	X						
WS22	X						
WS23	X						
WS24	X						
WS26	X						
WS30					X		
WS31	X						
WS34	X						
WS36						X	X
WS66	X	X	X	X	X		X

FIGURE 4.1-4

WATER LEVEL - ALLUVIAL WELLS
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YR 82 MO 6	7	8	9	10	11	12
WA01	X	X	X	X	X	X	X
WA02	X	X	X	X	X	X	X
WA03	X	X	X	X	X	X	X
WA05	X	X	X	X	X	X	X
WA06	X	X	X	X	X	X	X
WA07	X	X	X	X	X	X	X
WA08	X	X	X	X	X	X	X
WA09	X	X	X	X	X	X	X
WA11	X	X	X	X	X	X	X
WA12	X	X	X	X	X	X	X
WA55	X	X	X	X	X		
WA56	X	X	X	X	X		

WATER LEVEL - COMPOSITE WELLS
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YR 82 MO 6	7	8	9	10	11	12
WV01		X			X		
WV02		X			X		
WV03		X			X		
WV04		X			X		
WV05		X			X		
WV10		X	X				
WV37	X	X	X	X	X	X	X

FIGURE 4.1-4 (Contd)

WATER LEVEL - UPPER AQUIFER WELLS
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YR 82 MO 6	7	8	9	10	11	12
WX32	X	X	X	X	X		X
WX38	X	X	X	X	X	X	X
WX44	X	X	X	X	X	X	X
WX64		X			X		
WX65		X			X		
WX67		X			X		
WX69		X			X		
WX71					X		
WX72		X			X		
WX73		X			X		

WATER LEVEL - LOWER AQUIFER WELLS
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YR 82 MO 6	7	8	9	10	11	12
WY44	X	X	X	X	X	X	X
WY45	X	X	X	X	X	X	X
WY46	X	X	X	X	X		X
WY64		X			X		
WY65		X			X		
WY66		X			X		
WY67		X			X		
WY68		X			X		
WY69		X			X		
WY70		X			X		
WY71		X			X		
WY72		X			X		
WY75		X			X		
WY76		X			X		
WY77		X			X		
WY78		X			X		
WY79		X			X		
WY81	X	X	X	X	X	X	X

FIGURE 4.1-4 (Contd)

WATER LEVEL - BEDROCK WELLS
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YR 82 MO 6	7	8	9	10	11	12
WC17	X		X		X		X
WC91	X		X				
WD02	X	X	X	X	X	X	X
WD11				X			
WD12	X	X	X	X	X	X	X
WD14	X	X	X	X	X	X	X
WD15	X	X	X	X	X	X	X
WD17	X		X		X		X
WD18		X			X		
WD19	X	X	X	X	X	X	X
WD20	X		X	X	X	X	X
WD21	X	X	X	X		X	X
WD41	X	X	X		X		X
WD51	X	X	X	X		X	X
WD52	X	X	X	X	X	X	X
WD57	X		X		X		X
WD61	X	X	X	X	X	X	X
WD90	X	X	X	X		X	X
WD91	X		X				
WE03	X	X	X	X	X	X	X
WE04	X	X	X	X	X	X	X
WE11				X			
WE17	X		X		X		X
WE18		X			X		
WE20	X	X	X	X	X	X	X
WE21	X	X	X	X		X	X
WE41	X	X	X		X		X
WE51	X	X	X	X		X	X
WE52	X	X	X	X	X	X	X
WE61	X	X	X	X	X	X	X
WE91	X		X				
WG12	X	X	X	X	X	X	X
WG17	X		X		X		X
WG18		X			X		
WG20						X	X
WG21	X	X	X	X		X	X
WG41	X	X	X		X		X
WG51	X	X	X	X		X	X
WG52	X	X	X	X	X	X	X
WG61	X	X	X	X	X	X	X
WG91	X		X				
WH21	X	X	X	X		X	X

WC = UINTAH
WD = UPC1
WE = UPC2
WG = UPC3
WH = UPC4

FIGURE 4.1-4 (Contd)

WATER LEVEL - INJECTION WELLS
SAMPLING TIME INTERVAL
DATABASE STATUS

	YR 82 MO						
COMPUTER CODE	6	7	8	9	10	11	12
WI17	X	X	X	X	X	X	X
WI19	X	X	X	X	X	X	X

WATER LEVEL - SEEPAGE MONITORING WELLS
SAMPLING TIME INTERVAL
DATABASE STATUS

	YR 82 MO						
COMPUTER CODE	6	7	8	9	10	11	12
WW13	X	X	X	X	X	X	X
WW22	X	X	X	X	X	X	X
WW32	X	X	X	X	X	X	X

WATER LEVEL - SHAFT
SAMPLING TIME INTERVAL
DATABASE STATUS

	YR 82 MO						
COMPUTER CODE	6	7	8	9	10	11	12
WZ01	X	X	X	X	X	X	X

FIGURE 4.1-4 (Contd)

WELL LEVELS OF VARIOUS WELLS
CONTINUOUS 1-HOUR SAMPLES - HIGHEST DAILY LEVEL
DATABASE STATUS

	YEAR 82 MONTH 6	7	8	9	10	11	12
COMPUTER CODE							
WD12	X	X	X	X	X	X	
WD90						X	X
WG12	X	X	X	X	X	X	X
WS04	X	X	X	X	X	X	X
WS11	X	X	X	X	X	X	X
WS12	X	X	X	X	X	X	X
WX32	X	X					
WX38	X	X	X	X	X	X	X
WY44	X	X	X	X	X		

FIGURE 4.1-5

AIR QUALITY MONITORING
SAMPLING TIME INTERVAL
DATABASE STATUS

	YEAR 82 MONTH 10	11	12	6	7	8	9
COMPUTER CODE							
23	X	X	X	X	X	X	X

METEOROLOGICAL MONITORING
SAMPLING TIME INTERVAL
DATABASE STATUS

	YEAR 82 MONTH 10	11	12	6	7	8	9
COMPUTER CODE							
23	X	X	X	X	X	X	X

MECHANICAL WEATHER STATIONS
SAMPLING TIME INTERVAL
DATABASE STATUS

	YEAR 82 MONTH 10	11	12	6	7	8	9
COMPUTER CODE							
AD20				X	X		
AD28	X	X	X	X	X	X	X

STATION AD20 INCLUDES DATA FOR WIND SPEED AND DIRECTION, TEMPERATURE AND PRECIPITATION
STATION AD28 INCLUDES PRECIPITATION DATA ONLY

FIGURE 4.1-6

PARTICULATE LEVEL
24-HOUR CONTINUOUS SAMPLE EVERY 4TH DAY
DATABASE STATUS

COMPUTER CODE	YEAR 82 MONTH 6	7	8	9	10	11	12
023	X	X	X	X	X	X	X
026	X	X					

FIGURE 4.1-7

VISUAL RANGE
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YEAR 82 MONTH 6	7	8	9	10	11	12
AREA	X	X	X	X	X	X	X

FIGURE 4.1-8

DEER ROAD COUNT
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YEAR 82 MONTH 9	10	12
BM00	X	X	X
BM01	X	X	X
BM02	X	X	X
BM03	X	X	X
BM04	X	X	X
BM05	X	X	X
BM06		X	
BM07	X	X	X
BM08	X	X	X
BM09	X	X	X
BM10	X	X	
BM11	X	X	X
BM12	X	X	
BM13	X	X	
BM14	X	X	
BM15	X	X	
BM16	X	X	
BM17	X	X	X
BM18	X	X	
BM19	X	X	X
BM20	X	X	
BM21	X	X	
BM22	X	X	X
BM23	X	X	
BM24	X	X	X
BM25			X
BM26	X	X	
BM27	X	X	
BM28	X	X	X
BM29			X
BM31	X	X	
BM32	X	X	
BM33	X	X	
BM34	X	X	
BM35	X	X	X
BM36	X	X	
BM37	X	X	X
BM38	X	X	X
BM39	X	X	X
BM40	X	X	X
BM41	X	X	

FIGURE 4.1-9

DEER KILL ROAD COUNT
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YEAR 82 MONTH 9	10	12
BN00	X	X	
BN09			X
BN11			X
BN19			X
BN24			X
BN34			X
BN39			X

FIGURE 4.1-10

MICROCLIMATIC MONITORING
SAMPLING TIME INTERVAL
DATABASE STATUS

COMPUTER CODE	YEAR 82 MONTH 6	7	8	9	10	11	12
BC01							X
BC03	X	X	X	X	X	X	X
BC05	X	X	X	X	X	X	X
BC07	X	X	X	X	X	X	X
BC09	X	X	X	X	X	X	X

FIGURE 4.1-11

TRAFFIC COUNT
CONTINUOUS COUNT FOR MONTHLY 1 WEEK INTERVALS
DATABASE STATUS

COMPUTER CODE	YEAR 82 MONTH 6	7	8	9	11	12
BT01	X		X	X	X	X
BT02	X	X	X	X	X	X
BT03	X		X	X	X	X

TABLE 4.1-1

DESCRIPTION FOR RAMIS FILE NPDES
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	LOCATION	LOC	1	S	1	A	4
2	YEAR	YR	1	S	1	I	2
3	MONTH	MO	1	S	1	I	2
4	DAY	DY	1	S	1	I	2
5	FLOW	FLW	2	S	0	F	6.1
6	TOTSUSSOLID	TSS	2	S	0	F	6.1
7	TOTDISSOLID	TDS	2	S	0	F	6.1
8	FLORIDE	F	2	S	0	F	6.2
9	BORON	B	2	S	0	F	6.2
10	AMMONIA	NH3	2	S	0	F	6.2
11	PHENOL	PHEN	2	S	0	F	6.3
12	ALUMINUM	AL	2	S	0	F	6.1
13	IRON	FE	2	S	0	F	6.2
14	OLGR	OLGR	2	S	0	I	5
15	PH	PH	2	S	0	F	5.2
16	CADMIUM	CD	2	S	0	F	6.2
17	COPPER	CU	2	S	0	F	6.2
18	MERCURY	HG	2	S	0	D	8.5
19	SILVER	AG	2	S	0	F	6.2
20	ZINC	ZN	2	S	0	F	6.2
21	SPC	SPC	2	S	0	F	7.1
22	DO	DO	2	S	0	F	5.2
23	TEMP	TEMP	2	S	0	F	5.1
24	FTOTSUSSOLID	FTSS	2	S	0	F	5.1
25	COD	COD	2	S	0	F	7.3
26	FLORIDE/FLD	FF	2	S	0	F	7.1
27	TOTALALK	TALK	2	S	0	F	7.1
28	BICARBONATE	HCO3	2	S	0	F	7.1

RP0808: NUMBER OF RECORDS IN TABLE= 28 LINES= 28

TABLE 4.1-1 (Contd)

DESCRIPTION FOR RAMIS FILE NPDESSA
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	LOCATION	LOC	1	S	1	A	4
2	YEAR	YR	1	S	1	I	2
3	MONTH	MO	1	S	1	I	2
4	DAY	DY	1	S	1	I	2
5	TOTDISSOLID	TDS	2	S	1	F	6.1
6	FLORIDE	F	2	S	1	F	6.2
7	BORON	B	2	S	1	F	6.2
8	AMMONASN	NH3	2	S	1	F	6.3
9	PHENOL	PHEN	2	S	1	F	6.3
10	OILGREASE	OG	2	S	1	F	6.2
11	TMERCURY	THG	2	S	1	D	8.5
12	TALUMINUM	TAL	2	S	1	F	6.2
13	TARSENIC	TARS	2	S	1	F	6.2
14	TBARIUM	TBA	2	S	1	F	6.2
15	TCADMIUM	TCD	2	S	1	F	6.2
16	CALCIUM	CA	2	S	1	F	6.2
17	TCHROMIUM	TCR	2	S	1	F	6.2
18	TCOPPER	TCU	2	S	1	F	6.2
19	TIRON	TFE	2	S	1	F	6.2
20	TLEAD	TPB	2	S	1	F	6.2
21	TLITHIUM	TLI	2	S	1	F	6.2
22	MAGNESIUM	MG	2	S	1	F	6.2
23	TMANGANESE	TMN	2	S	1	F	6.2
24	TMOLYBDENUM	TMO	2	S	1	F	6.2
25	TNICKEL	TNI	2	S	1	F	6.2
26	TPOTASSIUM	TKA	2	S	1	F	6.2
27	SELENIUM	SE	2	S	1	D	8.4
28	TSILVER	TAG	2	S	1	F	6.2
29	TSODIUM	TNA	2	S	1	F	6.2
30	TSTRONTIUM	TSR	2	S	1	F	6.2
31	TZINC	TZN	2	S	1	F	6.2
32	TTITANIUM	TTI	2	S	1	F	6.2
33	TVANADIUM	TV	2	S	1	F	6.2
34	COD	COD	2	S	1	F	6.2
35	TOTALK	TALK	2	S	1	F	6.1
36	KJELDAHL	KJL	2	S	1	F	6.2
37	BICARBONATE	HCO3	2	S	1	F	6.1
38	BROMIDE	BR	2	S	1	F	6.1
39	CARBONATE	CO3	2	S	1	F	6.1
40	CHLORIDE	CL	2	S	1	F	6.1
41	NITRATE	NO3	2	S	1	F	6.1
42	SULFATE	SO4	2	S	1	F	6.1
43	SULFIDE	SO3	2	S	1	F	6.1
44	SILICA	SIO2	2	S	1	F	6.1
45	ALPHA	ALP	2	S	1	F	6.1
46	BETA	BET	2	S	1	F	6.1
47	RADIUM226	R226	2	S	1	F	6.3
48	URANIUM	U	2	S	1	D	8.4

TABLE 4.1-1 (Contd)

DESCRI-TION FOR RAMIS FILE NPDESSA
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
49	TZIRCONIUM	TZR	2	S	1	F	6.3
50	TBERYLLIUM	TBE	2	S	1	F	6.3
51	TBISMUTH	TBI	2	S	1	F	6.3
52	TGERMANIUM	TGR	2	S	1	F	6.3
53	TGALLIUM	TGA	2	S	1	F	6.3
54	CYANIDE	CYAN	2	S	1	F	6.3
55	CONDUCTIVITY	COND	2	S	1	F	6.1
56	PH	PH	2	S	1	F	5.1
57	DOC	DOC	2	S	1	F	6.1
58	HPHOBICTOT	HPBT	2	S	1	F	6.1
59	HPHOBICBAS	HPBB	2	S	1	F	6.1
60	HPHOBICACD	HPBA	2	S	1	F	6.1
61	HPHOBICNTL	HPBN	2	S	1	F	6.1
62	HPHILICTOT	HPLT	2	S	1	F	6.1
63	HPHILICBAS	HPLB	2	S	1	F	6.1
64	HPHILICACD	HPLA	2	S	1	F	6.1
65	HPHILICNTL	HPLN	2	S	1	F	6.1
66	NTRANTRI	NN	2	S	1	F	6.3
67	TEMP	TEMP	2	S	1	F	6.2
68	SUSSOLD	SUSS	2	S	1	F	6.2
69	TCS	TCESIUM137	2	S	1	F	6.2
70	SR90	SR90	2	S	1	F	6.2
71	DO	DO	2	S	1	F	6.2
72	NITRITE	NO3	2	S	1	F	6.2
73	TOC	TOC	2	S	1	F	6.2
74	FLORIDE/FLO	FF	2	S	1	F	6.2
75	TSS/FLO	TSSF	2	S	1	F	6.2
76	THIOCYANATE	SCN	2	S	1	F	6.2
77	DUMMY2	DM2	2	S	1	F	6.2
78	DUMMY3	DM3	2	S	1	F	6.2

RR080R: NUMBER OF RECORDS IN TABLE= 78 LINES= 78

TABLE 4.1-1 (Contd)

DESCRIPTION FOR RAMIS FILE SHAFTGW
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	LOCATION	LOC	1	S	1	A	4
2	YEAR	YR	2	S	1	I	2
3	MONTH	MO	2	S	1	I	2
4	DAY	DY	3	S	1	I	2
5	GROUT	GRT	3	S	1	I	2
6	PROBEHOLE	PBH	3	S	1	A	2
7	DEPTH	DP	3	S	1	I	5
8	ELEVATION	ELV	3	S	1	I	5
9	GPM	GPM	3	S	1	I	4
10	ALUMINUM	AL	3	S	1	F	6.3
11	ARSENIC	ARS	3	S	1	F	6.3
12	BARIUM	BA	3	S	1	F	6.2
13	BORON	B	3	S	1	F	6.2
14	CADMIUM	CD	3	S	1	F	6.3
15	CALCIUM	CA	3	S	1	F	6.1
16	CHROMIUM	CR	3	S	1	F	6.3
17	COBALT	CO	3	S	1	F	6.3
18	COPPER	CU	3	S	1	F	6.3
19	IRON	FE	3	S	1	F	6.2
20	LEAD	PB	3	S	1	F	6.3
21	LITHIUM	LI	3	S	1	F	6.2
22	MAGNESIUM	MG	3	S	1	F	6.1
23	MANGANESE	MN	3	S	1	F	6.3
24	MERCURY	HG	3	S	1	F	8.5
25	MOLYBDENUM	MOLY	3	S	1	F	6.3
26	NICKEL	NI	3	S	1	F	6.3
27	POTASSIUM	K	3	S	1	F	6.1
28	SELENIUM	SE	3	S	1	F	6.3
29	SILVER	AG	3	S	1	F	6.3
30	SODIUM	NA	3	S	1	F	7.1
31	STRONTIUM	SR	3	S	1	F	6.1
32	VANADIUM	V	3	S	1	F	6.3
33	ZINC	ZN	3	S	1	F	6.3
34	ALKALINITY	ALK	3	S	1	F	7.1
35	BICARBONATE	HCO3	3	S	1	F	7.1
36	CARBONATE	CO3	3	S	1	F	6.1
37	BROMIDE	BR	3	S	1	F	6.3
38	CHLORIDE	CL	3	S	1	F	7.1
39	FLUORIDE	F	3	S	1	F	6.2
40	HARDNESS	HARD	3	S	1	F	7.1
41	AMMONIA	NH3	3	S	1	F	6.3
42	KJELDNIT	KJN	3	S	1	F	6.1
43	NITRATE	NO3	3	S	1	F	6.2
44	BIOOXYDEMD	BOD	3	S	1	F	6.1
45	CHEMOXYDEM	COD	3	S	1	F	7.1
46	OILGREASE	OLGR	3	S	1	F	6.1
47	PHENOLS	PHEN	3	S	1	F	6.4
48	SILICA	SLC	3	S	1	F	6.1
49	SOLIDSDISS	TDS	3	S	1	F	7.1
50	SUSSOLID	SUSS	3	S	1	F	7.1
51	SULFATE	SO4	3	S	1	F	6.1
52	TURBIDITY	TURB	3	S	1	F	7.1
53	DISSORGCARB	DOC	3	S	1	F	6.1
54	TOTALCOLIF	TCOLIF	3	S	1	F	6.1
55	FECALCOLIF	FCOLIF	3	S	1	F	6.1
56	PH	PH	3	S	1	F	5.2
57	SPECCOND	SPC	3	S	1	F	6.1
58	DISSOXY	DO	3	S	1	F	5.1
59	TEMP	TEMP	3	S	1	F	4.1
60	[illegible]	[illegible]	3	S	1	F	6.1
61	DUM2	DUM2	3	S	1	F	6.1
62	[illegible]	[illegible]	3	S	1	F	6.1
63	DUM4	DUM4	3	S	1	F	6.1

REP300: NUMBER OF RECORDS IN TABLE= 63 LINES= 63

TABLE 4.1-1 (Contd)

DESCRIPTION FOR RAMIS FILE STEVEN
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	LOCATION	LOC	1	S	1	A	4
2	YEAR	YR	1	S	1	I	2
3	MONTH	MO	1	S	1	I	2
4	DAY	DY	2	S	1	I	2
5	DEPTH	DP	2	S	1	F	7.2

RP0808: NUMBER OF RECORDS IN TABLE= 5 LINES= 5

DESCRIPTION FOR RAMIS FILE WTRLEV
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	LOC	LOC	1	S	1	A	4
2	YR	YR	2	S	0	I	2
3	MO	MO	2	S	0	I	2
4	DY	DY	2	S	0	I	2
5	STATUS	ST	2	S	0	A	6
6	DEPTH	DP	2	S	0	F	9.4
7	TEMP	TEMP	2	S	0	F	5.1
8	PH	PH	2	S	0	F	4.1
9	DO	DO	2	S	0	F	5.1
10	SPC	SPC	2	S	0	F	6.1

RP0808: NUMBER OF RECORDS IN TABLE= 10 LINES= 10

DESCRIPTION FOR RAMIS FILE WTRUSAGE
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	SHAFT	SH	1	S	1	A	3
2	YEAR	YR	2	S	1	I	2
3	MONTH	MO	2	S	1	I	2
4	DAY	DY	2	S	1	I	2
5	FLOW	FL	2	S	1	F	6.1

RP0808: NUMBER OF RECORDS IN TABLE= 5 LINES= 5

TABLE 4.1-1 (Contd)

DESCRIPTION FOR RAMIS FILE WTRQLT
02/02/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	LOC	LOCATION	1	S	10	A	4
2	YR	YEAR	2	S	1	I	2
3	MO	MONTH	3	S	1	I	2
4	DY	DAY	4	S	1	I	2
5	TALK	TOTALK	4	S	1	F	7.1
6	AL	ALUMINUM	4	S	1	F	6.3
7	ARS	ARSENIC	4	S	1	F	5.3
8	FCOLIF	FCOLIF	4	S	1	F	7.2
9	BA	BARIUM	4	S	1	F	5.2
10	HCO3	BICARBONTE	4	S	1	F	7.1
11	BOD	BOD	4	S	1	F	6.1
12	B	BORON	4	S	1	F	6.2
13	BR	BROMIDE	4	S	1	F	6.3
14	TCOLIF	TCOLIF	4	S	1	F	7.1
15	CD	CADIUM	4	S	1	F	6.3
16	CA	CALCIUM	4	S	1	F	6.1
17	CO3	CARBONATE	4	S	1	F	6.1
18	CL	CHLORIDE	4	S	1	F	7.1
19	CR	CHROMIUM	4	S	1	F	6.3
20	COD	COD	4	S	1	F	7.1
21	CU	COPPER	4	S	1	F	6.3
22	DO	DISSOXY	4	S	1	F	4.1
23	DOC	DOC	4	S	1	F	5.1
24	LAS	LASSURF	4	S	1	F	6.2
25	F	FLORIDE	4	S	1	F	6.2
26	HARD	HARDNESS	4	S	1	F	7.1
27	FE	IRON	4	S	1	F	5.2
28	KJN	KJELDNIT	4	S	1	F	5.2
29	PB	LEAD	4	S	1	F	6.3
30	LI	LITHIUM	4	S	1	F	5.2
31	MG	MAGNESIUM	4	S	1	F	5.1
32	MN	MANGANESE	4	S	1	F	6.3
33	HG	MERCURY	4	S	1	D	8.5
34	MOLY	MOLYBDENUM	4	S	1	F	6.3
35	NI	NICKEL	4	S	1	F	6.3
36	NO3	NITRATE	4	S	1	F	7.2
37	OLGR	OILGREASE	4	S	1	F	5.1
38	S2O3	S2O3	4	S	1	F	5.1
39	PH	PH	4	S	1	F	4.1
40	K	POTASSIUM	4	S	1	F	5.1
41	RA	ALPHA	4	S	1	F	5.1
42	BTR	BETA	4	S	1	F	5.1
43	RR	RADIUM226	4	S	1	F	5.1
44	SE	SELENIUM	4	S	1	F	6.3
45	AG	SILVER	4	S	1	F	6.3
46	NA	SODIUM	4	S	1	F	7.1
47	TDS	TDS	4	S	1	F	7.1
48	SOLS	SOLSOLIDS	4	S	1	F	7.1

TABLE 4.1-1 (Contd)

DESCRIPTION FOR RAMIS FILE WTRQLT
02/02/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
49	SPC	SPECCOND	4	S	1	F	7.1
50	SR	STRONTIUM	4	S	1	F	4.1
51	SO4	SULFATE	4	S	1	F	6.1
52	TEMP	TEMP	4	S	1	F	4.1
53	ZN	ZINC	4	S	1	F	6.3
54	TOC	TOC	4	S	1	F	5.1
55	PHEN	PHENOLS	4	S	1	F	6.4
56	CYAN	CYANIDE	4	S	1	F	6.3
57	NH3	AMMONIA	4	S	1	D	8.3
58	PST	PHOSPHATE	4	S	1	F	6.2
59	SIO2	SILICA	4	S	1	F	6.1
60	U	URANIUM	4	S	1	F	5.3
61	SUSS	SUSSOLID	4	S	1	F	7.1
62	TH	THORIUM	4	S	1	F	6.3
63	CS	CESIUM	4	S	1	F	6.3
64	I	IODINE	4	S	1	F	6.3
65	SB	ANTIMONY	4	S	1	F	6.3
66	ZR	ZIRCONIUM	4	S	1	F	6.3
67	Y	YTTRIUM	4	S	1	F	5.3
68	RB	RUBIDIUM	4	S	1	F	6.3
69	GE	GERMAIUM	4	S	1	F	6.3
70	GA	GALLIUM	4	S	1	F	6.3
71	TI	TITANIUM	4	S	1	F	6.3
72	SC	SCANDIUM	4	S	1	F	6.3
73	W	TUNGSTEN	4	S	1	F	6.3
74	CO	COBALT	4	S	1	F	6.3
75	V	VANADIUM	4	S	1	F	6.3
76	BE	BERRYLLIUM	4	S	1	F	5.3
77	OH	HYDROXIDES	4	S	1	F	5.1
78	CH	CONDHYDCARD	4	S	1	F	7.3
79	PA	PALK	4	S	1	F	7.1
80	MA	MOALK	4	S	1	F	7.1
81	SCN	THIOCYANATE	4	S	1	F	6.2
82	TURB	TURBIDITY	4	S	1	F	7.1
83	FF	FLORIDE/FLD	4	S	1	F	7.1
84	TSSF	TSS/FLD	4	S	1	F	7.1
85	R228	RADIUM228	4	S	1	F	7.1

RP0808: NUMBER OF RECORDS IN TABLE= 85 LINES= 85

TABLE 4.1-2

DESCRIPTION FOR RAMIS FILE LTLAIR
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	TRAILER	TRL	1	S	2	A	3
2	YEAR	YR	2	S	0	A	2
3	MONTH	MO	2	S	0	A	2
4	DAY	DY	3	S	31	A	2
5	HOUR	HR	3	S	31	A	2
6	NITROGOX	NOX	3	S	31	F	6.1
7	NITRICOX	NO	3	S	31	F	6.1
8	SULFDIOX	SO2	3	S	31	F	6.1
9	WINDSP30	WS	3	S	31	F	6.1
10	WINDDIR30	WD	3	S	31	F	6.1
11	RELATHUMID	RH	3	S	31	F	6.1
12	TEMINTRL	TIN	3	S	31	F	6.1
13	TEMOUT30	TOUT	3	S	31	F	6.1
14	SOLRAD	SR	3	S	31	F	6.1
15	HYDROGSULF	H2S	3	S	31	F	6.1
16	LINEVOLT	VOLT	3	S	31	F	6.1
17	TOTHYDCARB	THC	3	S	31	F	6.1
18	METHANE	CH4	3	S	31	F	6.1
19	CARBMONOX	CO	3	S	31	F	6.1
20	OZONE	O3	3	S	31	F	6.1
21	BARPRESS	PRES	3	S	31	F	6.1
22	WINDSTDDEV	WSD	3	S	31	F	6.1
23	RAINFALL	RAIN	3	S	31	F	6.1
24	NITROGDIOX	NO2	3	S	31	F	6.1
25	NONMETHHC	NMHC	3	S	31	F	6.1

RP0808: NUMBER OF RECORDS IN TABLE= 25 LINES= 25

Table 4.1-2 (Contd)

DESCRIPTION FOR [illegible] FILE METAIR
[illegible]

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	TOWER	TOW	1	S	1	A	3
2	YEAR	YR	2	S	0	A	2
3	MONTH	MO	2	S	0	A	2
4	DAY	DY	3	S	31	A	2
5	HOUR	HR	3	S	31	A	2
6	WINDSP8	WS1	3	S	31	F	6.1
7	WINDDIR8	WD1	3	S	31	F	6.1
8	RELHUM08	RH1	3	S	31	F	6.1
9	TEMP8	TMP1	3	S	31	F	6.1
10	WINDSP30	WS2	3	S	31	F	6.1
11	WINDDIR30	WD2	3	S	31	F	6.1
12	RELHUM30	RH2	3	S	31	F	6.1
13	TEMP30	TMP2	3	S	31	F	6.1
14	WINDSP100	WS3	3	S	31	F	6.1
15	WINDDIR100	WD3	3	S	31	F	6.1
16	RELHUM100	RH3	3	S	31	F	6.1
17	TEMP100	TMP3	3	S	31	F	6.1
18	WINDSP200	WS4	3	S	31	F	6.1
19	WINDDIR200	WD4	3	S	31	F	6.1
20	RELHUM200	RH4	3	S	31	F	6.1
21	TEMP200	TMP4	3	S	31	F	6.1
22	DELTTEMP1	DT1	3	S	31	F	6.1
23	DELTTEMP2	DT2	3	S	31	F	6.1
24	BIVWS30	BWS1	3	S	31	F	6.1
25	HORWD30	HWD1	3	S	31	F	6.1
26	VERTWD30	VWD1	3	S	31	F	6.1
27	BIVWS100	BWS2	3	S	31	F	6.1
28	HORWD100	HWD2	3	S	31	F	6.1
29	VERTWD100	VWD2	3	S	31	F	6.1
30	BIVWS200	BWS3	3	S	31	F	6.1
31	HORWD200	HWD3	3	S	31	F	6.1
32	VERTWD200	VWD3	3	S	31	F	6.1
33	WINDSD8	WDV1	3	S	31	F	6.1
34	WINDSD30	WDV2	3	S	31	F	6.1
35	WINDSD100	WDV3	3	S	31	F	6.1
36	WINDSD200	WDV4	3	S	31	F	6.1
37	HWINDSD30	HSD1	3	S	31	F	6.1
38	VWINDSD30	VSD1	3	S	31	F	6.1
39	HWINDSD100	HSD2	3	S	31	F	6.1
40	VWINDSD100	VSD2	3	S	31	F	6.1
41	HWINDSD200	HSD3	3	S	31	F	6.1
42	VWINDSD200	VSD3	3	S	31	F	6.1

RPQR08: NUMBER OF RECORDS IN TABLE= 42 LINES= 42

Table 4.1-2 (Contd)

DESCRIPTION FOR RAMIS FILE MRIDATA
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	STATION	ST	1	S	4	A	4
2	YEAR	YR	2	S	0	A	2
3	MONTH	MO	2	S	0	A	2
4	DAY	DY	3	S	31	A	2
5	HOUR	HR	3	S	31	A	2
6	WINDSP	WS	3	S	31	F	6.1
7	WINDDR	WD	3	S	31	F	6.1
8	TEMP	TEMP	3	S	31	F	6.1
9	SRZPR	SRPR	3	S	31	F	6.1

RP0808: NUMBER OF RECORDS IN TABLE= 9 LINES= 9

DESCRIPTION FOR RAMIS FILE PARTIC
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	TRAILER	TRL	1	S	4	A	4
2	YEAR	YR	2	S	0	I	2
3	MONTH	MO	2	S	0	I	2
4	DAY	DY	3	S	31	I	2
5	PARTICULATE	PART	3	S	31	F	6.1

RP0808: NUMBER OF RECORDS IN TABLE= 5 LINES= 5

DESCRIPTION FOR RAMIS FILE VRANGE
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	TRAILER	TRL	1	S	1	A	4
2	YEAR	YR	2	S	0	I	2
3	MONTH	MO	2	S	0	I	2
4	DAY	DY	3	S	0	I	2
5	RANGE	RNG	3	S	0	F	6.1

RP0808: NUMBER OF RECORDS IN TABLE= 5 LINES= 5

TABLE 4.1-3

DESCRIPTION FOR RAMIS FILE DEERCNT
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL NAME	LEVEL TYPE	SEGMENT FACTOR	FORMAT	
1	MILE	ML	1	S	1	A	4
2	YEAR	YR	2	S	1	I	2
3	MONTH	MO	2	S	1	I	2
4	DAY	DY	2	S	1	I	2
5	WEATHER	WTHR	2	S	1	A	20
6	COUNT	CNT	2	S	1	I	4

RP0808: NUMBER OF RECORDS IN TABLE= 5 LINES= 6

DESCRIPTION FOR RAMIS FILE DRKILL
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL NAME	LEVEL TYPE	SEGMENT FACTOR	FORMAT	
1	MILE	ML	1	S	42	A	4
2	YEAR	YR	2	S	10	I	2
3	MONTH	MO	3	S	12	I	2
4	DAY	DY	4	S	31	I	2
5	STRESS	STR	5	S	1	A	5
6	COUNT	CNT	5	S	1	I	4
7	SEX	SX	5	S	1	A	2
8	AGE	AG	6	S	1	A	10
9	WEATHER	WTHR	7	U	1	A	20

RP0808: NUMBER OF RECORDS IN TABLE= 9 LINES= 9

DESCRIPTION FOR RAMIS FILE MICRO
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	STATION	ST	1	S	2	A	4
2	YEAR	YR	2	S	0	I	2
3	MONTH	MO	3	S	0	I	2
4	DAY	DY	4	S	0	I	2
5	STATID	SID	5	S	0	A	2
6	TEMPMAXIM	TPMX	5	S	0	F	5.1
7	TEMPMINIM	TPMN	5	S	0	F	5.1
8	SRFTPMAX	STPMX	5	S	0	F	5.1
9	SRFTPMIN	STPMN	5	S	0	F	5.1
10	PRECIP	PR	5	S	0	F	5.2
11	SNODPTH	SD	5	S	0	F	5.1
12	SNOMOIST	SM	5	S	0	F	5.1

RP0808: NUMBER OF RECORDS IN TABLE= 12 LINES= 12

DESCRIPTION FOR RAMIS FILE TRAF
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL NAME	LEVEL TYPE	SEGMENT FACTOR	FORMAT	
1	LOCATION	LOC	1	S	3	A	4
2	YEAR	YR	2	S	0	I	2
3	MONTH	MO	2	S	0	I	2
4	DAY	DY	2	S	0	I	2
5	HOUR	HR	3	S	0	I	2
6	INTRAF	IT	3	S	0	I	2
7	OUTRAF	OT	3	S	0	I	5

RP0808: NUMBER OF RECORDS IN TABLE= 7 LINES= 7

TABLE 4.1-4

DESCRIPTION FOR RAMIS FILE ACRADAR
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	TRAILER	TRL	1	S	1	A	4
2	YEAR	YR	2	S	0	A	2
3	MONTH	MO	2	S	0	A	2
4	DAY	DY	3	S	31	A	2
5	HOUR	HR	3	S	31	A	2
6	MIXHGT	MIX	3	S	31	F	6.1
7	STBCLS1	STB1	3	S	31	F	6.1
8	INVERHGT	INV	3	S	31	F	6.1
9	STBCLS2	STB2	3	S	31	F	6.1

RP0808: NUMBER OF RECORDS IN TABLE= 9 LINES= 9

DESCRIPTION FOR RAMIS FILE STLAIR
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	TRAILER	TRL	1	S	3	A	3
2	YEAR	YR	2	S	0	A	2
3	MONTH	MO	2	S	0	A	2
4	DAY	DY	3	S	31	A	2
5	HOUR	HR	3	S	31	A	2
6	SULFDIOX	SO2	3	S	31	F	6.1
7	WINDSP30	WS	3	S	31	F	6.1
8	WINDDIR30	WD	3	S	31	F	6.1
9	RELATHUMID	RH	3	S	31	F	6.1
10	TEMINTRL	TIN	3	S	31	F	6.1
11	TEMOUT30	TOUT	3	S	31	F	6.1
12	HYDROGSULF	H2S	3	S	31	F	6.1
13	LINEVOLT	VOLT	3	S	31	F	6.1
14	BARPRESS	PRES	3	S	31	F	6.1
15	WINDSTDDEV	WSD	3	S	31	F	6.1
16	RAINFALL	RAIN	3	S	31	F	6.1

RP0808: NUMBER OF RECORDS IN TABLE= 15 LINES= 16

DESCRIPTION FOR RAMIS FILE PIBAL
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL NAME	LEVEL TYPE	SEGMENT FACTOR	FORMAT
1	YR	YEAR	1	S	1	I 2
2	MO	MONTH	1	S	1	I 2
3	DY	DAY	1	S	1	I 2
4	TM	TIME	1	S	1	A 2
5	HT	HEIGHT	1	S	1	I 5
6	DIR	DIRECTION	1	S	1	I 4
7	SP	SPEED	1	S	1	F 5.1
8	TMP	TEMP	1	S	1	F 5.1

RP0808: NUMBER OF RECORDS IN TABLE= 8 LINES= 8

Table 4.1-4 (Contd)

DESCRIPTION FOR RAMIS FILE EVAPORATION
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	TRL	TRAILER	1	S	1	A	4
2	YR	YEAR	1	S	1	I	2
3	MO	MONTH	1	S	1	I	2
4	DY	DAY	1	S	1	I	2
5	EVPAV	EVPAVER	1	S	1	F	7.3
6	EVPTOT	EVPTOTAL	1	S	1	F	7.3
7	WAV	WINDAVER	1	S	1	F	6.1
8	WTOT	WINDTOTAL	1	S	1	F	6.1

RP0808: NUMBER OF RECORDS IN TABLE= 8 LINES= 8

DESCRIPTION FOR RAMIS FILE INJECTR
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL	LEVEL TYPE	SEGMENT FACTOR	TYPE	LENGTH
1	LOC	LOC	1	S	1	A	4
2	YR	YR	2	S	0	I	2
3	MO	MO	2	S	0	I	2
4	DY	DY	2	S	0	I	2
5	HR	HR	2	S	0	I	2
6	MN	MN	2	S	0	I	2
7	LEV	LEV	2	S	0	F	7.2

RP0808: NUMBER OF RECORDS IN TABLE= 7 LINES= 7

DESCRIPTION FOR RAMIS FILE BIRDS
02/01/83

LIST	FIELDNAME	SYNONYM	LEVEL NAME	LEVEL TYPE	SEGMENT FACTOR	FORMAT
1	TRANSECT	TRAN	1	S	1	I 2
2	YEAR	YR	2	S	1	I 2
3	GROUPNO	GN	2	S	1	I 2
4	SPEICES	SP	2	S	1	A 5
5	COUNT	CNT	2	S	1	I 4

RP0808: NUMBER OF RECORDS IN TABLE= 5 LINES= 5

STATION COMPUTER
CODE

4.2 Station Computer Code

Four-digit computer codes have been designated for monitoring stations to be used with a computerized data base management system (RAMIS). A major portion of the raw data collected at the C-b Tract is retained in RAMIS. Once entered the data can be retrieved for reporting and/or statistical analysis. The codes reduce storage space and provide a systematic identification to access station data sets. The code consists of two letters followed by two numbers.

AB23

> Station Number

> Study or Category
(Example: air quality trailer)

> Program area
Examples:

A = air
N = noise
W = water
B = biology
P = photography

The codes are presented in Table 4.2-1 for the environmental program along with the current station designations. This list contains codes for all the sampling/monitoring stations ever designated for environmental data collection. An attempt has been made throughout this report to refer to all stations in terms of their four-digit codes.

Table 4.2-1
COMPUTER CODE AND STATION I.D. CROSS-REFERENCE

I Air Quality & Meteorology

	Station Designation		Computer Code
Met. Tower:	@ Sta.	023	AA23
Trailers:		020	AB20
		021	AB21
		022	AB22
		023	AB23
		024	AB24
Acoustic Radar	Sta.	020	AC20
		021	AC21
		023	AC23
MRI and Particulates	Sta.	020	AD20
		031	AD31
		032	AD32
		033	AD33
		041	AD41
		042	AD42
		043	AD43
		044	AD44
		056	AD56
Visibility	View	I	AV01
	View	II	AV02
	View	III	AV03
	View	IV	AV04

II Biology

Deer Pellet Group Densities

Vegetation Type	Location	Treatment	Transect (Computer Code)
CPJ	Off Tract	Control	BA01
			BA02
			BA03
			BA04
			BA05
			BA06
			BA07
			BA08
			BA09
	On Tract		BA17
			BA18
			BA25
			BA28
			BA29
			BA30
			BA31

Biology (Cont'd)

Vegetation Type	Location	Treatment	Transect (Computer Code)
CPJ	On Tract	Development	BA32
		Sprinkler	BA20
		Development	BA21
			BA23
PJ	Off Tract	Control	BA13
			BA14
			BA15
		Development	BA10
			BA11
			BA12
			BA16
	On Tract	Control	BA19
			BA26
			BA27
		Development	BA22
			BA24
Brush Beaten* SB	Off Tract	Development	BA41
			BA42
			BA43
			BA44
			BA45
			BA46
			BA47
			BA48
			BA49

Biology (Cont'd)

Programs: Deer Distribution & Migration and Road Kills

Mile Marker	Location	Computer Code: North & East of Piceance Creek Road	Computer Code: Meadows; South & West of Piceance Creek Road
41	White River City	BN41	BM41
40	Piceance Bridge	BN40	BM40
39	Lower Canyon	BN39	BM39
38	Piceance Canyon	BN38	BM38
37	Yellow Creek	BN37	BM37
36	Stinking Springs	BN36	BM36
35	Old Bridge	BN35	BM35
34	Little Hills Turnoff	BN34	BM34
33	Old Corrals & Buildings	BN33	BM33
32	Burk Ranch	BN32	BM32
31	Ranch	BN31	BM31
30		BN30	BM30
29		BN29	BM29
28	Bureau of Mines	BN28	BM28
27	Ryan Gulch	BN27	BM27
26	Pump Station	BN26	BM26
25		BN25	BM25
24	Rock School	BN24	BM24
23	AQ 021	BN23	BM23
22	Pat Johnson's Ranch	BN22	BM22
21	Hunter Creek	BN21	BM21
20	PL Gate	BN20	BM20
19	AQ 020	BN19	BM19
18	Sorghum, Cottonwood	BN18	BM18
17	Stewart Gulch Rd.	BN17	BM17
16	AQ Trailer 022	BN16	BM16
15	Oldland's Ranch	BN15	BM15
14	Oldland's Ranch	BN14	BM14
13	Pond and Cabin	BN13	BM13
12	Sprague Gulch	BN12	BM12
11	Cascade Gulch	BN11	BM11
10	13 Mile Gulch	BN10	BM10
9	14 Mile Gulch	BN09	BM09
8	Schutte Gulch	BN08	BM08
7	Robinson's Ranch	BN07	BM07
6		BN06	BM06
5	2 Old Cabins (35 MPH Curve)	BN05	BM05
4	McCarthy Gulch	BN04	BM04
3	Cow Creek	BN03	BM03
2	Mahogany Outcropping	BN02	BM02
1	Woodward Ranch	BN01	BM01
0	Rio Blanco Store	BN00	BM00

Biology (Cont'd)

Programs	General Location	Computer Code
Deer Mortality	North Side of Piceance Creek	BD01
		BD02
		BD03
		BD04
		BD05
		BD06
	South Side of Piceance Creek	BD07
		BD08
		BD09
		BD10
Deer Age Class	General Area of Tract	BF01
Coyote Abundance	8 Transects for Total for 30 miles	BF01
	15 mi seg. near Hunter (Control)	BF02 thru BF08
	15 mi seg. on & South of Tract (Development)	
Lagomorph Abundance	Identical Locations to Deer Pellet Group Densities	BA01 to BA49
Small Mammals	Piceance Creek (Development)	BG01
	On-Tract-West	BG02
	Piceance Creek (Control)	BG03
	On-Tract-East	BG04
	Sprinkler Area Section B	BG05
	Sprinkler Area (Control)	BG11
	Sprinkler Area (Development	BG22
	Sprinkler Area (Control)	BG33
Avifauna		
Songbirds and Gamebirds	N.W. of Tract-near Jimmy PJ-CH-C	BH01
	On-Tract-Scandard PJ- -D	BH02
	On-Tract-Cottonwood PJ-CH-D	BH03
	S. of Tract-Between W&N Fork Stewart PJ-CH-C	BH04
	Sprinkler	BH05
Raptors	The Entire Tract and Surrounding Study Areas.	BI01
Aquatic Ecology		
Benthos	USGS 09306007 (Control)	WU07
	USGS 09306058 (Development)	WU58
	USGS 09306061 (Development)	WU61
Periphyton	Piceance Creek Upstream (Control)	WP01
		WP02
	Piceance Creek Downstream (Development)	WP03

Biology (Cont'd)

Programs	General Location	Computer Code		
Water Quality	USGS 09306061 (Development)	WU61		
Vegetation				
Community Structure	Plots	*	**	***
	Chained pinyon juniper (1978)(Dev)	BJ01	BJ11	BJ21
	Chained pinyon juniper (1978)(Cont)	BJ02	BJ12	BJ22
	Upland sagebrush (1980)(Cont)	BJ03	BJ13	BJ23
	Bottomland sagebrush (1980)(Cont)	BJ04	BJ14	BJ24
	Pinyon juniper woodland (1979)(Dev)	BJ05	BJ15	BJ25
	Pinyon juniper woodland (1979)(Cont)	BJ06	BJ16	BJ26

Biology (Cont'd)

Program	General Location	Computer Code
Micro Climate	MC Sta. 1	BC01
	2	BC02
	3	BC03
	4	BC04
	5	BC05
	6	BC06
	7	BC07
	8	BC08
	9	BC09
	13	BC13
Traffic Count	Rio Blanco Store	BT01
	South of Cattle Guard	BT02
	Rio Blanco Lake	BT03

III Noise

	Station Designation	Computer Code
Traffic Noise	Sta.	
	IX	NB01
	XV	NB15

IV Photography

	P1	PA01
	P2	PA02
	P3	PA03
	P4	PA04
	P5	PA05
	P6	PA06
	P7	PA07
	P8	PA08
	P9	PA09
	P10	PA10
	P11	PA11
	P12	PA12
	P13	PA13
	P14	PA14
	P15	PA15
	P16	PA16
	P17	PA17
	P18	PA18
	P19	PA19
	P20	PA20
	P21	PA21
	P22	PA22
	P23	PA23
	P24	PA24
	P25	PA25

Photography

Program	General Location	Computer Code
Photography	P26	PA26
	P27	PA27
	P28	PA28
	P29	PA29
	P30	PA30
	P31	PA31
	P32	PA32
	P33	PA33
	P34	PA34
	P35	PA35

V. Water

Program	Station Designation	Computer Code	Elevation(ft)
U.S.G.S. Stream Gauging Station	09304800	WU48	
	09306007	WU07	
	09306036	WU36	
	09306039	WU39	
	09306042	WU42	
	09306061	WU61	
	09306050	WU50	
	09306052	WU52	
	09306058	WU58	
	09306033	WU33	
	09306025	WU25	
	09306015	WU15	
	09306028	WU28	
	09306022	WU22	
	09306200	WU00	
	09306222	WU62	
	09306255	WU55	
Alluvial Wells	A-1	WA01	6282.2
	A-2	WA02	6284.5
	A-3	WA03	6448.6
	A-4	WA04	0000.0
	A-5	WA05	6345.0
	A-5A	WA55	6460.0
	A-5B	WA56	0000.0
	A-6	WA06	6360.0
	A-7	WA07	6383.8
	A-8	WA08	6409.0
	A-9	WA09	6540.2
	A-10	WA10	6610.6
	A-11	WA11	6503.8
	A-12	WA12	6691.8
	A-13	WA13	0000.0
Springs and Seeps	CB S-1	WS01	
	CB S-2	WS02	
	CB S-3	WS03	
	CB S-4	WS04	
	CB S-6	WS06	
	CB S-6A	WS66	
	CB S-7	WS07	
	CB S-8	WS08	
	CB S-9	WS09	
	CB S-10 (W-3)	WS10 (WS34)	
	CB Seep A	WS11	
	S-102	WS12	
	CER-1	WS21	
	B-3	WS22	
	H-3	WS23	
	F-3	WS24	

V. Water

Program	Station Designation	Computer Code	Elevation(ft)
Springs and Seeps (cont)	Figure 4-A	WS25	
	W-4	WS26	
	W-9	WS27	
	CER-7	WS28	
	S-9	WS29	
	P3 & P3A	WS30	
	CER-6	WS31	
	W-2 (S-9)	WS32	
	S-2	WW33	
	W-3 (CB S-10)	WS34 (WS10)	
	Figure 4	WS35	
	S-11 (S-101)	WS36	
	Oldland Spring	WS37	
Precipitation	CB-020	AB20	
	CB-023	AB23	
	LH	WR01	
	M	WR02	
	SG	WR03	
	CG	WR04	
	JOS	WR05	
	EFPC	WR06	
	EMFPC	WR07	
	UCBW	WR08	

V. <u>Water (cont'd)</u>
<u>Upper Aquifer Wells</u>

Before Recompletions			Recompletion #1			Recompletion #2		
Station	Code	Elevation(ft)	Station	Code	Date	Station	Code	Date
CB-2	WX02	6737.0	CB-2	WD02	11-18-80			
CB-4	WX04	7057.3	CB-4	WE04	11-20-80			
SG-10A	WX10	6953.6	SG-10A-1	WE10	*	SG-10A-1	WG51	
			SG-10A-2	WD10	*	SG-10A-2	WE51	*
						SG-10A-Annulus	WD51	
SG-1A	WX11	6425.0	SG-1A-1	WE11	12-12-80			
			SG-1A-2	WD11	12-12-80			
SG-1-2	WX12	6428.6	SG-1 -2	WD12	11-01-80			
14X-7	WX14	6909.0	14X-7-1	WD14	11-15-80			
			14X-7-2	WD15	11-15-80			
SG-17-2	WX17	7038.6				SG-17-2	WE17	11-03-80
						SG-17-3	WD17	11-03-80
						SG-17-4	WC17	11-03-80
SG-18A	WX18	7386.6	SG-18A-1	WG18	12-02-80			
			SG-18A-2	WE18	12-01-80			
			SG-18A-3	WD18	12-02-80			
SG-19	WX19	6384.4	SG-19	WD19				
SG-20	WX20	6358.0	SG-20-1	WG20	11-15-80			
			SG-20-2	WE20	11-15-80			
			SG-20-3	WD20	11-15-80			
SG-21	WX21	6813.3	SG-21-1	WH21	12-08-80			
			SG-21-2	WG21	12-08-80			
			SG-21-3	WE21	12-08-80			
			SG-21-4	WD21	12-09-80			
AT-1C-3	WX44	6906.0						
SG-11-3	WX55	6903.1				SG-11-3	WD52	10-18-80
SG-6-3	WX63	6890.7	SG-6-3	WD61	10-20-80			
SG-8-2	WX82	0000.0						
SG-9-2	WX92	6873.0	SG-9-2	WE91	12-11-80			
			SG-9-3	WD91	12-11-80			
			SG-9-4	WC91	12-12-80			
32X-12	WX32	6830.3						
33X-1	WX33	6707.1						
41X-1	WX41	6460.0						
TH75-5A	WX64	7178.0						
TH75-13A	WX65	6390.0						
TH75-18A	WX67	6740.0						
TH75-9A	WX69	7350.0						
CER RB-D-02	WX71	6580.0						
TH75-15A	WX72	6805.0						
UNION 8-1	WX73	8142.3						
COLONY 12-596	WX74	0000.0						
TH-5	WX75	7583.2						

* Recompletion #1 not satisfactory for these strings: use #2.

V. Water (cont'd)

Lower Aquifer Wells

Before Completion			Recompletion #1			Recompletion #2		
Station	Code	Elevation'	Station	Code	Date	Station	Code	Date
CB-1	WY01	6763.4	CB-1	WD01	11-14-80			
CB-3	WY03	6743.1	CB-3	WE03	11-18-80			
SG-10	WY09	6952.5	SG-10R	WG10		SG-10	WD90	
SG-1-1	WY12	6428.8	SG-1-1	WG12	11-1-80			
SG-17-1	WY18	7038.6	SG-17-1R	WY17		SG-17-1	WG17	11-03-80
AT-1C-1	WY45	6906.0						
AT-1C-2	WY46	6906.0						
SG-11-1	WY51	6903.1	SG-11-1R	WY52		SG-11-1	WG52	10-18-80
SG-11-2	WY54	6903.1				SG-11-2	WE52	10-18-80
SG-6-1	WY61	6890.7	SG-6-1	WE61	10-20-80			
SG-6-2	WY62	6890.7	SG-6-2	WG61	10-20-80			
SG-8	WY80	6540.8	SG-8R	WY81				
SG-9-1	WY91	6873.0	SG-9-1	WG91	12-11-80			
AT-1	WY44	6909.0						
TH75-5B	WY64	7178.0						
TH75-13B	WY65	6390.0						
EQUITY-1	WY66	6286.0						
TH75-10B	WY68	6840.0						
TH75-9B	WY69	7350.0						
EQUITY-S-1A	WY70	7070.0						
CER RB-D-03	WY71	6580.0						
TH75-15B	WY72	6805.0						
TG71-3	WY75	6820.0						
TG71-5	WY76	6865.0						
GETTY 9-40	WY77	7777.8						
TG71-4	WY78	7145.0						
EQUITY BS-13	WY79	7020.0						

New Wells

Station	Code	Date	Elevation (ft)
SG-17A	WD57	12-02-80	7036.0
AT-1D-1	WG41	11-16-80	6909.0
AT-1D-2	WE41		
AT-1D-3	WD41	11-16-80	6909.0
AT-1A	WV37		6909.0
AT-1A1	WX38		6909.0
AT-1B	WV40		6909.0

V. Water (cont'd)

	Before Recompletions			Recompletion #1		
	Station	Code	Elevation'	Station	Code	Date
Composite Wells:						
	GREENO 404	WV01	6411.0			
	OLDLAND 3	WV02	6490.0			
	GP-17X-BG	WV03				
	BUTE 25	WV04				
	LIBERTY BELL 12	WV05	7420.0			
	TOSCO WELL	WV06				
	21X12	WV07	6794.8			
	22X1	WV08	6704.1			
	43X2	WV09	6692.7			
Seepage Monitoring Wells:						
	32Y-12	WW32				
	31X-12	WW12	6764.	31X12	WW22	11/80
	41X-13-2	WW13	6953.6			
Reinjection Wells:	22X-17	WI19				
	11X-18	WI18	6950.0			
	24X-17	WI17				
Le Claire Filter:	BEFORE FILTER	WO01				
	AFER FILTER	WO02				
	AT REINJECTION POINT	WO03				
Ponds:						
	POND A	WN01				
	POND B	WN02				
	POND C	WN03				
	POND A SPRINGS	WN11				
	POND B SPRINGS	WN12				
	POND C SPRINGS	WN13				
	POND A INLET	WN21				
	POND B INLET	WN22				
	POND C INLET	WN23				
	POND A-B CROSSOVER	WN31				
	POND B OUTLET	WN32				
	POND C OUTLET	WN33				
	BACKWASH POND	WN04				
	BACKWASH POND SPRINGS	WN14				
	BACKWASH POND INLET	WN24				
	BACKWASH POND OUTLET	WN34				
	POND A-B DISCHARGE	WN40				
Shafts:						
	V/E SHAFT PROBE HOLES	WZ01				
	SERVICE SHAFT PROBE HOLES	WZ02				
	PRODUCTION SHAFT PROBE HOLES	WZ03				
	V/E SHAFT WATER RING	WZ11				
	SERVICE SHAFT WATER RING	WZ12				
	PRODUCTION SHAFT WATER RING	WZ13				

V. Water (cont'd)

	Before Recompletions			Recompletion #1		
	Station	Code	Elevation'	Station	Code	Date
	V/E SHAFT SUMP	WZ21				
	SERVICE SHAFT SUMP	WZ22				
	PRODUCTION SHAFT SUMP	WZ23				
	V/E SHAFT	WZ31				
	PRODUCTION SHAFT	WZ33				
	SHAFT GROUT HOLE	WZ41				
Discharge Monitoring Stations						
	NO NAME GULCH	WU42				
	UPPER PICEANCE CREEK	WN41				
	LOWER PICEANCE CREEK	WN42				
	HUNTER CREEK	WU02				
	WILLOW CREEK	WU01				
Mobil Wells	WELL NO. 1	MW01	6510			
	WELL NO. 2	MW03	6480			
	WELL NO. 3	MW03	6618			
	WELL NO. 12	MW12	6486			
	WELL NO. 13	MW13	6509			

4.3 Station Coordinates

Environmental monitoring stations have been specified by station computer code, latitude and longitude, township and range, Colorado State coordinates and elevations. In cases where stations represent biological transects several meters in length, the coordinates reported are those of a point on the map near the station label. A jacket map of the Tract area (Figure 4.3-1) showing all monitoring stations on and near Tract C-b, required by the Interim Monitoring Program, and a jacket map (Vol. I, Figure 2.2-1) of off tract monitoring stations, required by Water Augmentation Plan, contain the four-digit computer station codes.

ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
I. AIR QUALITY AND METEOROLOGY				
AA23	39° 47' 43" 108° 12' 57"	T3S R96W Sec 18 NW1/4, NW1/4, NW1/4	N 180,000 E 1,237,045	6950'
AB20	39° 50' 10" 108° 13' 08"	T2S R97W Sec 36 NE1/4, SE1/4, NE1/4	N 194,845 E 1,236,605	6280'
*AB23	39° 47' 44"* 108° 12' 54"	T3S R96W Sec 18 NE1/4, NW1/4, NW1/4	N 180,000 E 1,237,234	6950'
AB24 *	39° 48' 49" 108° 12' 21"	T3S R96W Sec 6 NE1/4, SW1/4, SE1/4	N 186,542 E 1,240,000	6750'
AB26			N 166,900 E 1,235,200	
AC20	39° 50' 08" 108° 13' 06"	T2S R97W Sec 36 NE1/4, SE1/4, NE1/4	N 194,594 E 1,236,794	6310'
AD42	39° 48' 58" 108° 13' 08"	T3S R97W Sec 1 SE1/4, NE1/4, SE1/4	N 187,548 E 1,236,417	6720'
AD56* *	39° 49' 31" 108° 12' 23"*	T3S R96W Sec 6 NE1/4, NW1/4, NE1/4	N 190,760 E 1,240,005	6380'
II. BIOLOGY				
*BA01 *	39° 50' 15"* 108° 16' 12"*	T2S R97W Sec 34 SW1/4, NE1/4, NW1/4	N 195,788 E 1,222,268	6480'
*BA02 *	39° 50' 3"* 108° 16' 4"*	T2S R97W Sec 34 SE1/4, SW1/4, NW/14	N 194,594 E 1,222,079	6500'
BA03	39° 49' 32" 108° 16' 5"	T3S R97W Sec 3 NE1/4, NE1/4, NW1/4	N 191,388 E 1,222,708	6640'
BA04	39° 49' 12" 108° 15' 46"	T3S R97W Sec 3 NE1/4, NW1/4, SE1/4	N 189,371 E 1,224,091	6600'
BA05	39° 48' 39" 108° 16' 14"	T3S R97W Sec 3 SW1/4, SE1/4, SW1/4	N 186,039 E 1,221,828	6720'
BA06	39° 48' 19" 108° 16' 19"	T3S R97W Sec 10 SE1/4, SW1/4, NW1/4	N 184,028 E 1,221,388	6780'
BA07	39° 47' 49" 108° 16' 28"	T3S R97W Sec 10 NW1/4, SW1/4, SW1/4	N 181,074 E 1,220,571	6860'

* Plane Coordinate Projection Tables, Colorado, Special Publication No. 276, U.S. Government Printing Office.

ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
BA08	39° 47' 33" 108° 16' 38"	T3S R97W Sec 16 NE1/4, SE1/4, NE1/4	N 179,497 E 1,218,748	6860'
BA09	39° 47' 9" 108° 16' 49"	T3S R97W Sec 16 SE1/4, NW1/4, SE1/4	N 177,108 E 1,218,805	6940'
BA10	39° 50' 48" 108° 14' 20"	T2S R97W Sec 25 SW1/4, SW1/4, NW1/4	N 198,868 E 1,231,137	6600'
BA11	39° 50' 46" 108° 13' 42"	T2S R97W Sec 25 SE1/4, NE1/4, SW1/4	N 198,554 E 1,234,091	6580'
BA12	39° 50' 29" 108° 13' 8"	T2S R97W Sec 25 SE1/4, SE1/4, SE1/4	N 196,731 E 1,236,668	6600'
BA13	39° 49' 52" 108° 12' 5"	T2S R96W Sec 31 SE1/4, NE1/4, SE1/4	N 192,834 E 1,241,451	6600'
BA14	39° 49' 52" 108° 10' 55"	T2S R96W Sec 33 SW1/4, NW1/4, SW1/4	N 192,645 E 1,246,920	6700'
BA15	39° 49' 46" 108° 10' 30"	T2S R96W Sec 33 NW1/4, SE1/4, SW1/4	N 192,079 E 1,248,868	6600'
BA16	39° 49' 56" 108° 14' 9"	T2S R97W Sec 36 NW1/4, NW1/4, SW1/4	N 193,525 E 1,231,828	6500'
BA17	39° 48' 32" 108° 14' 38"	T3S R97W Sec 11 SW1/4, NW1/4, NE1/4	N 185,097 E 1,229,308	6680'
BA18	39° 47' 49" 108° 14' 25"	T3S R97W Sec 14 NW1/4, NE1/4, NE1/4	N 180,760 E 1,230,131	6820'
BA19	39° 47' 56" 108° 14' 2"	T3S R97W Sec 12 NE1/4, SW1/4, SW1/4	N 181,451 E 1,232,017	6680'
BA20	39° 48' 0" 108° 12' 32"	T3S R96W Sec 7 SE1/4, SE1/4, NW1/4	N 182,142 E 1,238,554	6860'
BA21	39° 4' 6" 108° 12' 33"	T3S R96W Sec 7 NE1/4, SE1/4, SW1/4	N 181,640 E 1,239,057	6820'
BA22	39° 47' 4" 108° 12' 5"	T3S R96W Sec 18 SE1/4, NE1/4, SW1/4	N 176,165 E 1,238,742	6860'
BA23	39° 48' 51" 108° 12'	T3S R96W Sec 7 NE1/4, SE1/4, SE1/4	N 181,954 E 1,241,137	6840'

* Plane Coordinate Projection Tables, Colorado, Special Publication No. 276, U.S. Government Printing Office.

ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
BA24	39° 48' 51" 108° 11' 51"	T3S R96W Sec 5 NE1/4, SW1/4, SW1/4	N 186,668 E 1,242,398	6640'
BA25	39° 47' 16" 108° 11' 46"	T3S, R96W Sec 17 NW1/4, NE1/4, SW1/4	N 177,045 E 1,242,457	7000'
BA26	39° 48' 8" 108° 10' 52"	T3S, R96W Sec 9 NW1/4, NW1/4, SW1/4	N 182,142 E 1,246,857	6840'
BA27	39° 47' 4" 108° 11' 13"	T3S R96W Sec 16 NW1/4, SW1/4, SW1/4	N 175,725 E 1,245,034	7020'
BA28	39° 48' 28" 108° 14' 29"	T3S R97W Sec 11 SE1/4, NW1/4, NE1/4	N 184,657 E 1,230,000	6680'
BA29a	39° 47' 43" 108° 14' 16"	T3S R97W Sec 14 NE1/4, NE1/4, NE1/4	N 180,068 E 1,230,885	6860'
BA29b	39° 47' 38" 108° 14' 23"	T3S R97W Sec 14 SW1/4, NE1/4, NE1/4	N 179,622 E 1,230,320	6900'
BA30	39° 48' 49" 108° 12' 35"	T3S R96W Sec 6 NE1/4, SE1/4, SW1/4	N 186,542 E 1,238,931	6720'
BA31	39° 48' 23" 108° 12' 40"	T3S R96W Sec 7 NE1/4, SE1/4, NW1/4	N 183,965 E 1,238,491	6820'
BC01	39° 47' 56" 108° 11' 58"	T3S R97W Sec 8 NW1/4, SW1/4, SW1/4	N 181,137 E 1,241,640	6860'
BC02	39° 47' 48" 108° 14' 22"	T3S R97W Sec 11 SW1/4, SE1/4, SE1/4	N 180,634 E 1,230,382	6860'
BC03	39° 46' 57" 108° 12' 1"	T3S R96W Sec 17 SW1/4 SW1/4, SW1/4	N 175,097 E 1,241,262	7100'
BC04	39° 47' 28" 108° 13' 32"	T3S R97W Sec 13 NW1/4, SW1/4, NE1/4	N 178,491 E 1,234,217	6700'
BC05	39° 48' 3" 108° 11' 58"	T3S R96W Sec 8 SE1/4, NW1/4, SW1/4	N 181,765 E 1,241,702	6840'
BC06	39° 47' 54" 108° 10' 44"	T3S R96W Sec 9 SE1/4, SW1/4, SW1/4	N 180,697 E 1,247,422	6900'
BC07	39° 47' 44" 108° 13' 17"	T3S R97W Sec 13 NW1/4, NE1/4, NE1/4	N 180,068 E 1,235,474	6940'

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ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
BC08	39° 50' 30" 108° 13' 36"	T2S R97W Sec 25 NW1/4, SW1/4, SW1/4	N 196,920 E 1,234,468	6350'
BC09	39° 49' 30" 108° 11' 53"	T3S R96W Sec 5 NE1/4, NW1/4, NW1/4	N 190,634 E 1,242,331	6400'
BC13	39° 47' 19" 108° 11' 20"	T3S R96W Sec 17 NE1/4, NW1/4, SE1/4	N 177,234 E 1,244,531	6700'
BD01	39° 50' 59" 108° 14' 26"	T2S R97W Sec 26 SE1/4, SE1/4, NE1/4	N 200,000 E 1,230,697	6380'
BD02	39° 50' 44" 108° 13' 55"	T2S R97W Sec 25 NW1/4, NE1/4, SW1/4	N 198,428 E 1,233,022	6370'
BD03	39° 50' 34" 108° 12' 57"	T2S R96W Sec 30 SW1/4, SW1/4, SW1/4	N 197,171 E 1,237,548	6420'
BD04	39° 50' 3" 108° 12' 19"	T2S R96W Sec 31 SW1/4, SE1/4, NE1/4	N 194,028 E 1,240,445	6420'
BD05	39° 50' 9" 108° 11' 41"	T2S R96W Sec 32 NW1/4, SE1/4,NW1/4	N 194,468 E 1,243,400	6420'
BD06	39° 49' 46" 108° 10' 34"	T2S R96W Sec 33 NW1/4, SE1/4, SW1/4	N 192,017 E 1,248,554	6500'
BD07	39° 49' 51" 108° 13' 16"	T2S R97W Sec 36 SW1/4, NE1/4, SE1/4	N 192,897 E 1,235,914	6380'
BD08	39° 49' 46" 108° 12' 43"	T2S R96W Sec 31 NW1/4, SE1/4, SW1/4	N 192,394 E 1,238,491	6360'
BD09	39° 49' 26" 108° 12' 28"	T3S R96W Sec 6 SW1/4, NW1/4, NE1/4	N 190,257 E 1,239,559	6410'
BD10	39° 49' 17" 108° 11' 49"	T3S R96W Sec 5 NE1/4, SW1/4, NW1/4	N 189,245 E 1,242,582	6420'
		Coordinates Picked Near Transect Map Code Level		
BF01	39° 47' 53" 108° 16' 35"	T3S R97W Sec 9 NE1/4, SE1/4, SE1/4	N 181,514 E 1,220,068	6900'
BF02	39° 48' 02" 108° 14' 27"	T3S R97W Sec 11 SW1/4, NE1/4, SE1/4	N 182,017 E 1,230,068	6800'
BF03	39° 46' 40" 108° 13' 32"	T3S R97W Sec 24 NW1/4, SW1/4, NE1/4	N 173,651 E 1,234,091	6860'

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ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
BF04	39° 46' 25" 108° 13' 04"	T3S R97W Sec 24 NE1/4, NE1/4, SE1/4	N 172,017 E 1,236,228	7190'
BF05	39° 47' 30" 108° 12' 9"	T3S R96W Sec 18 NE1/4, SE1/4, NE1/4	N 178,491 E 1,240,697	6980'
BF06	39° 47' 44" 108° 11' 43"	T3S R96W Sec 17 NW1/4, NE1/4, NW1/4	N 179,874 E 1,242,771	6940'
BF07	39° 46' 09" 108° 11' 49"	T3S R96W Sec 20 SW1/4, SE1/4, SW1/4	N 170,257 E 1,242,017	6820'
BF08	39° 47' 31" 108° 11' 9"	T3S R96W Sec 16 NE1/4, SW1/4, NW1/4	N 178,491 E 1,245,411	6950'
BG01	39° 50' 17" 108° 13' 58"	T2S R97W Sec 36 SW1/4, NE1/4, NW1/4	N 195,662 E 1,232,708	6360'
BG02	39° 47' 46" 108° 13' 23"	T3S R97W Sec 13 NE1/4, NW1/4, NE1/4	N 180,320 E 1,234,971	6940'
BG03	39° 49' 39" 108° 12' 10"	T2S R96W Sec 31 SE1/4, SE1/4, SE1/4	N 191,577 E 1,241,011	6300'
BG04	39° 47' 40" 108° 10' 55"	T3S R96W Sec 16 SW1/4, NW1/4, NW1/4	N 179,371 E 1,246,542	6860'
BH01	39° 48' 46" 108° 15' 59"	T3S R97W Sec 5 SE1/4, SE1/4, SW1/4	N 186,731 E 1,223,022	6660'
BH02	39° 47' 59" 108° 13' 38"	T3S R97W Sec 12 SW1/4, SW1/4, SE1/4	N 181,640 E 1,233,902	6780'
BH03	39° 48' 14" 108° 13' 1"	T3S R96W Sec 7 SW1/4, NW1/4, SW1/4	N 183,085 E 1,236,794	6840'
BH04	39° 46' 48" 108° 10' 56"	T3S R96W Sec 20 NE1/4, SE1/4, NE1/4	N 174,091 E 1,246,291	7120'
BJ01	39° 47' 56" 108° 11' 58"	T3S R96W Sec 8 NW1/4, SW1/4, SW1/4	N 181,137 E 1,241,640	6860'
BJ02	39° 47' 43" 108° 14' 23"	T3S R97W Sec 14 NW1/4, NE1/4, NE1/4	N 180,194 E 1,230,320	6870'
BJ03	39° 46' 58" 108° 12' 3"	T3S R96W Sec 17 SW1/4, SW1/4, SW1/4	N 175,285 E 1,241,074	7100'

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ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
BJ04	39° 47' 24" 108° 13' 30"	T3S R97W Sec 13 SE1/4, SW1/4, NE1/4	N 178,114 E 1,234,405	6700'
BJ05	39° 48' 08" 108° 11' 54"	T3S R96W Sec 8 SE1/4, NW1/4, SW1/4	N 182,268 E 1,242,017	6840'
BJ06	39° 47' 53" 108° 10' 42"	T3S R96W Sec 9 SE1/4, SW1/4, SW1/4	N 180,634 E 1,247,611	6880'
III. NOISE				
NA02	39° 50' 43" 108° 14' 19"	T2S R97W Sec 25 SW1/4, NW1/4, SW1/4	N 198,302 E 1,231,200	6520'
NA09	39° 49' 08" 108' 14' 17"	T3S R97W Sec 2 SE1/4, SE1/4, NE1/4	N 188,679 E 1,231,074	6660'
NA22	39° 50' 43" 108° 14' 19"	T2S R97W Sec 25 SW1/4, NW1/4, SW1/4	N 198,302 E 1,231,200	6520'
NB01		TS35 R96W Sec 1	N 187,422 E 1,234,405	
NB15	39° 49' 04" 108° 13' 26"	T3S R97W Sec 1 NE/14, NW1/4, SE1/4	N 188,177 E 1,234,971	6720'
IV. PHOTOGRAPHY				
PA01	39° 51' 50" 108° 11' 23"	T2S R96W Sec 20 SW1/4, SW1/4, NE1/4	N 204,714 E 1,245,097	7420'
PA02	39° 50' 44" 108° 14' 5"	T2S R97W Sec 25 SE1/4, NW1/4, SW1/4	N 198,365 E 1,232,268	6560'
PA03	39° 50' 23" 108° 14' 7"	T2S R97W Sec 36 NE1/4, NW1/4, NW1/4	N 196,291 E 1,232,079	6300'
PA04	39° 49' 58" 108° 13' 11"	T2S R97W Sec 26 NE/14, NE1/4, SE1/4	N 193,651 E 1,236,354	6410'
PA05	39° 49' 03" 108° 14' 41"	T3S R97W Sec 2 NW1/4, NW1/4, SE1/4	N 188,239 E 1,229,119	6410'
PA06	39° 48' 55" 108° 14' 5"	T3S R97W Sec 1 SW1/4, NW1/4, SW1/4	N 187,422 E 1,231,954	6770'
PA07	39° 48' 55" 108° 13' 57"	T3S R97W Sec 1 SE1/4, NW1/4, SW1/4	N 187,359 E 1,232,582	6770'

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ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
PA08	39° 49' 18" 108° 13' 49"	T3S R97W Sec 1 NW1/4, SE1/4, NW1/4	N 189,685 E 1,233,274	6760'
PA09	39° 48' 53" 108° 12' 20"	T3S R96W Sec 6 NE1/4, SW1/4, SE1/4	N 186,920 E 1,240,131	6750'
PA10	39° 49' 30" 108° 11' 50"	T3S R96W Sec 5 NE1/4, NW1/4, NW1/4	N 190,634 E 1,242,582	6430'
PA11	39° 48' 41" 108° 11' 47"	T3S R96W Sec 5 SW1/4, SE1/4, SW1/4	N 185,662 E 1,242,645	6700'
PA12	39° 48' 47" 108° 11' 28"	T3S R96W Sec 5 SW1/4, SW1/4, SE1/4	N 186,228 E 1,244,154	6740'
PA13	39° 49' 33" 108° 11' 44"	T2S R96W Sec 32 SE1/4, SW1/4, SE1/4	N 190,885 E 1,243,085	6500'
PA14	39° 48' 22" 108° 14' 29"	T3S R97W Sec 11 NE1/4, SW1/4, NE1/4	N 184,091 E 1,229,937	6700'
PA15	39° 48' 21" 108° 14' 3"	T3S R97W Sec 12 NE1/4, SW1/4, NW1/4	N 183,902 E 1,232,017	6670'
PA16	39° 47' 56" 108° 13' 49"	T3S R97W Sec 12 NE1/4, SE1/4, SW1/4	N 181,325 E 1,233,022	6730'
PA17	39° 48' 35" 108° 13' 19"	T3S R97W Sec 12 NW1/4, NE1/4, NE1/4	N 185,285 E 1,235,474	6760'
PA18	39° 48' 31" 108° 13' 10"	T3S R97W Sec 12 SW1/4, NE1/4, NE1/4	N 184,782 E 1,236,165	6820'
PA19	39° 47' 50" 108° 12' 57"	T3S R96W Sec 7 SW1/4, SW1/4, SW1/4	N 180,697 E 1,237,045	6870'
PA20	39° 48' 4" 108° 12' 47"	T3S R96W Sec 7 SW1/4, NE1/4, SW1/4	N 182,017 E 1,237,862	6890'
PA21	39° 47' 46" 108° 12' 5"	T3S R96W Sec 18 NE1/4, NE1/4, NE1/4	N 180,068 E 1,241,074	6920'
PA22	39° 48' 16" 108° 11' 34"	T3S R96W Sec 8 SE1/4, SE1/4, NW1/4	N 183,085 E 1,243,588	6860'
PA23	39° 48' 38" 108° 10' 57"	T3S R96W Sec 8 NE1/4, NE1/4, NE1/4	E 185,222 E 1,246,542	6540'

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ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
PA24	39° 47' 57" 108° 10' 44"	T3S R96W Sec 9 NE1/4, SW1/4, SW1/4	N 181,074 E 1,247,422	6880'
PA25	39° 48' 10" 108° 10' 24"	T3S R96W Sec 9 NE1/4, NE1/4, SW1/4	N 182,268 E 1,248,994	6520'
PA26	39° 47' 25" 108° 13' 39"	T3S R97W Sec 13 SE1/4, SE1/4, NW1/4	N 178,239 E 1,233,714	6770'
PA27	39° 47' 22" 108° 12' 58"	T3S R96W Sec 18 SW1/4, SW1/4, NW1/4	N 177,862 E 1,236,857	6980'
PA28	39° 47' 8" 108° 12' 58"	T3S R96W Sec 18 NW1/4, SW1/4, SW1/4	N 176,417 E 1,236,794	7010'
PA29	39° 46' 57" 108° 11' 20"	T3S R96W Sec 17 SW1/4, SW1/4, SE1/4	N 175,034 E 1,244,405	6700'
PA30	39° 46' 58" 108° 10' 48"	T3S R96W Sec 16 SW1/4, SW1/4, SW1/4	N 175,034 E 1,246,920	7120'
PA31	39° 47' 46" 108° 10' 45"	T3S R96W Sec 16 NE1/4, NW1/4, NW1/4	N 179,874 E 1,247,359	6920'
PA32	39° 47' 25" 108° 10' 18"	T3S R96W Sec 16 SW1/4, SW1/4, NE1/4	N 177,737 E 1,249,371	6640'
PA33	39° 46' 58" 108° 13' 00"	T3S R96W Sec 18 SW1/4, SW1/4, SW1/4	N 175,411 E 1,236,605	7060'
PA34	39° 46' 53" 108° 12' 5"	T3S R96W Sec 19 NE1/4, NE1/4, NE1/4	N 174,720 E 1,240,948	7120'
PA35	39° 45' 21" 108° 13' 6"	T3S R97W Sec 25 NE1/4, SE1/4, SE1/4	N 165,537 E 1,235,851	7400'
V. WATER				
WA01	39° 50' 31" 108° 13' 54"	T2S R97W Sec 25 SW1/4, SE1/4, SW1/4	N 197,108 E 1,233,085	6300'
WA02	39° 50' 10" 108° 14' 37"	T2S R97W Sec 35 NE1/4, SW1/4, NE1/4	N 195,034 E 1,229,685	6280'
WA03	39° 48' 48" 108° 14' 32"	T3S R97W Sec 2 NE1/4, SW1/4, SE1/4	N 186,731 E 1,229,811	6460'

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ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
WA04	39° 47' 26" 108° 13' 35"	T3S R97W Sec 13 SW1/4, SW1/4, NE1/4	N 178,302 E 1,234,028	6700'
WA05	39° 50' 4" 108° 13' 14"	T2S R97W Sec 36 SW1/4, SE1/4, NE1/4	N 194,217 E 1,236,102	6330'
WA06	39° 49' 36" 108° 12' 25"	T2S R96W Sec 31 SE1/4, SW1/4, SE1/4	N 191,262 E 1,239,874	6360'
WA07	39° 49' 31" 108° 11' 59"	T3S R96W Sec 5 NW1/4, NW1/4, NW1/4	N 190,697 E 1,241,891	6370'
WA08	39° 49' 12" 108° 11' 8"	T3S R96W Sec 5 SW1/4, SE1/4, NE1/4	N 188,679 E 1,245,788	6400'
WA09	39° 48' 10" 108° 10' 22"	T3S R96W Sec 9 NE1/4, NE1/4, SW1/4	N 182,268 E 1,249,182	6420'
WA10	39° 47' 25" 108° 10' 24"	T3S R96W Sec 16 SE1/4, SE1/4, NW1/4	N 177,800 E 1,248,931	6580'
WA11	39° 48' 18" 108° 11' 7"	T3S R96W Sec 8 SW1/4, SE1/4, NE1/4	N 183,211 E 1,245,725	6550'
WA12	39° 46' 58" 108° 11' 25"	T3S R96W Sec 17 SW1/4, SW1/4, SE1/4	N 175,159 E 1,244,028	6700'
WA13	39° 47' 13" 108° 12' 34"	T3S R96W Sec 18 SW1/4, NW1/4, SE1/4	N 176,857 E 1,238,679	6840'
WC91/WD91 WE91/WG91	39° 47' 48" 108° 14' 20"	T3S R97W Sec 11 SE1/4, SE1/4, SE1/4	N 180,634 E 1,230,571	6873.0'
WC17/WD17 WE17/WG17	39° 46' 58" 108° 10' 51"	T3S R96W Sec 16 SW1/4, SW1/4, SW1/4	N 175,034 E 1,246,668	7038.6'
WD01	39° 48' 52" 108° 14' 3"	T3S R96W Sec 1 NE1/4, SW1/4, SW1/4	N 187,045 E 1,232,079	6763.4'
WD02	39° 48' 56" 108° 12' 22"	T3S R96W Sec 6 SE1/4, NW1/4, SE1/4	N 197,234 E 1,240,000	6737.0'
WD11/WE11	39° 48' 52" 108° 14' 35"	T3S R96W Sec 2 NW1/4, SE1/4	N 187,171 E 1,229,600	6425.0'
WD12/WG12	39° 48' 52" 108° 14' 36"	T3S R97W Sec 2 NE1/4, SW1/4, SE1/4	N 187,171 E 1,229,497	6428.8'

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STATION CODE	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
WD14/WD15	39° 47' 46" 108° 13' 41"	T3S R96W Sec 7 NE1/4, SW1/4	N 180,200 E 1,238,300	6909.0'
WD18/WE18 WG18	39° 45' 19" 108° 13' 08"	T3S R97W Sec 25 SE1/4, SE1/4	N 165,438 E 1,235,125	7386.6'
WD19	39° 49' 31" 108° 11' 59"	T3S R96W Sec 5 NW1/4, NW1/4, NW1/4	N 190,760 E 1,241,891	6384.4'
WD20/WE20 WG20	39° 49' 33" 108° 12' 24"	T3S R96W Sec 31 SE1/4, SW1/4, SE1/4	N 191,011 E 1,239,937	6358.0'
WD21/WE21 WG21/WH21	39° 48' 57" 108° 13' 24"	T3S R97W Sec 13 SE1/4, SW1/4, SE1/4	N 175,348 E 1,234,782	6813.3'
WD41/WE41 WG41	39° 38' 21" 112° 10' 06"	T3S R96W Sec 7 NE1/4, SW1/4	N 182,000 E 1,238,000	6909.0'
WD51/WE51 WG51	39° 47' 36" 108° 13' 06"	T3S R97W Sec 13 NE1/4, NE1/4, NE1/4	N 180,257 E 1,236,291	6953.6'
WD52/WE52 WG52	39° 47' 48" 108° 12' 7"	T3S R96W Sec 7 SE1/4, SE1/4, SE1/4	N 180,320 E 1,240,948	6903.1'
WD57	39° 46' 47" 108° 10' 51"	T3S R96W Sec 16 SW1/4, SW1/4, SW1/4	N 175,034 E 1,246,668	7036.0'
WD61/WE61 WG61	39° 48' 13" 108° 12' 32"	T3S R96W Sec 7 NW1/4, NW1/4, SE1/4	N 182,897 E 1,239,057	6890.7'
WD90	39° 47' 46" 108° 13' 05"	T3S R97W Sec 13 NE1/4, NE1/4	N 180,312 E 1,236,375	6952.5'
WE03	39° 48' 51" 108° 11' 29"	T3S R96W Sec 5 NW1/4, SW1/4, SE1/4	N 186,605 E 1,244,091	6743.1'
WE04	39° 47' 11" 108° 12' 4"	T3S R96W Sec 17 SE1/4, NW1/4, SW1/4	N 176,542 E 1,241,074	7057.3'
WI17		T3S R96W Sec 17 SE1/4 SW1/4		6994.0'
WI18	39° 47' 46" 108° 13' 05"		N 180,300 E 1,236,375	6950.0'
WI19		T3S R96W Sec 17 SE1/4 SW1/4	N 178,394 E 1,243,549	6942.2'
WP01	39° 49' 35" 108° 11' 2"	T2S R96W Sec 32 SE1/4, SE1/4, SE1/4	N 190,948 E 1,246,291	6380'

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STATION CODE	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
WP02	39° 49' 41" 108° 12' 2"	T2S R96W Sec 32 NW1/4, SW1/4, SW1/4	N 1,191,702 E 1,241,702	6300'
WP03	39° 51' 03" 108° 15' 27"	T2S R97W Sec 26 NW1/4, SW1/4, NW1/4	N 200,502 E 1,225,977	6220'
WR01	40° 00' 108° 12'	T1S R96W Sec 6	OFF TRACT	6140'
WR02	40° 02'	T1N R94W Sec 7	OFF TRACT	6347'
WR03		T4S R97W Sec 34	OFF TRACT	
WR04		T2S R100W Sec 14	OFF TRACT	
WR05		T5S R94W Sec 26	OFF TRACT	
WR06		T6S R94W Sec 2	OFF TRACT	
WR07			OFF TRACT	
WS01	39° 49' 30" 108° 11' 2"	T3S R96W Sec 5 NE1/4, NE1/4, NE1/4	N 190,445 E 1,246,291	6380'
WS02	39° 48' 3" 108° 10' 16"	T3S R96W Sec 9 SW1/4, NW1/4, SE1/4	N 181,577 E 1,249,622	6540'
WS03	39° 49' 1" 108° 11' 9"	T3S R96W Sec 5 NW1/4, NE1/4, NE1/4	N 190,634 E 1,245,788	6360'
WS04	39° 48' 1" 108° 10' 13"	T3S R96W Sec 9 NE1/4, SW1/4, SE1/4	N 181,388 E 1,249,874	6550'
WS06	39° 50' 23" 108° 14' 38"	T2S R97W Sec 35 NE1/4, NW1/4, NE1/4	N 196,354 E 1,229,622	6260'
WS07	39° 50' 17" 108° 14' 33"	T2S R97W Sec 35 SW1/4, NE1/4, NE1/4	N 195,788 E 1,230,000	6280'
WS08	39° 48' 57" 108° 14' 48"	T3S R97W Sec 11 SE1/4, NE1/4, SE1/4	N 187,674 E 1,228,554	6400'
WS09	39° 47' 51" 108° 14' 53"	T3S R97W Sec 14 NW1/4, NE1/4, SW1/4	N 181,011 E 1,227,988	6550'
WS10	39° 47' 16" 108° 15' 2"	T3S R97W Sec 2 SE1/4, NE1/4, SW1/4	N 177,485 E 1,227,171	6580'

* Plane Coordinate Projection Tables, Colorado, Special Publication No. 276, U. S. Government Printing Office.

ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
WS11	39° 48' 13" 108° 12' 40"		N 182,900 E 1,238,400	
WS12	39° 50' 09" 108° 13' 12"		N 194,800 E 1,236,300	
WS21	39° 51' 20" 108° 19' 15"	T2S, R97W, Sec 19 SW1/4, SE1/4	OFF TRACT	
WS22	39° 49' 29" 108° 24' 56"	T2S, R98W, Sec 32 SW1/4, SE1/4	OFF TRACT	
WS23	39° 47' 22" 108° 17' 57"	T3S, R97W, Sec 17 NW1/4, SE1/4	OFF TRACT	
WS24	39° 46' 27" 108° 22' 43"	T3S, R98W, Sec 22 NW1/4, SE1/4	OFF TRACT	
WS25	39° 42' 56" 108° 29' 03"	T4S, R99W, Sec 10 NE1/4, SE1/4	OFF TRACT	
WS26	39° 47' 37" 108° 15' 51"	T3S, R97W, Sec 27 Center	OFF TRACT	
WS27	39° 40' 51" 108° 16' 50"	T4S, R97W, Sec 21 SW1/4, SE1/4	OFF TRACT	
WS28	39° 44' 50" 108° 10' 05"	T3S, R96W, Sec 33 SW1/4, NE1/4	OFF TRACT	
WS29	39° 40' 55" 108° 12' 50"	T4S, R96W, Sec 19 SW1/4, SW1/4	OFF TRACT	
WS30	39° 47' 42" 108° 06' 09"	T3S, R95W, Sec 18 NW1/4, NW1/4	OFF TRACT	
WS31	39° 48' 25" 108° 10' 34"	T3S, R96W, Sec 9 SE1/4, NW1/4	N 184,187 E 1,248,184	
WS32	39° 47' 36" 108° 14' 59"	T3S, R97W, Sec 14 NE1/4, NW1/4	OFF TRACT	
WS33	39° 47' 18" 108° 10' 22"	T3S, R96W, Sec 16 NE1/4, SW1/4	OFF TRACT	
WS34	39° 47' 17" 108° 15' 03"	T3S, R97W, Sec 14 NW1/4, SW1/4	OFF TRACT	

* Plane Coordinate Projection Tables, Colorado, Special Publication No. 276, U.S. Government Printing Office.

ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE+	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
WS36	39° 48' 42" 108° 10' 52"		N 185,500 E 1,247,000	
WU01	39° 46' 10" 108° 15' 16"	T3S R97W Sec 22 E1/4, N1/4, E1/4	N 170,875 E 1,225,875	
WU02		T3S R97W Sec 8 SE1/4, S1/4, E1/4	OFF TRACT	
WU07	39° 49' 31" 108° 10' 59"	T3S R96W Sec 5 NE1/4, NE1/4, NE1/4	N 190,634 E 1,246,542	6400
WU15	39° 47' 20" 108° 10' 23"	T3S R96W Sec 16 NE1/4, NE1/4, SW1/4	N 177,234 E 1,248,931	6600
WU22	39° 48' 45" 108° 10' 60"	T3S R96W Sec 5 SE1/4, SE1/4, SE1/4	N 185,914 E 1,246,354	6460
WU25	39° 46' 57" 108° 11' 21"	T3S R96W Sec 17 SE1/4, SW1/4, SE1/4	N 175,097 E 1,244,342	6680'
WU28	39° 48' 42" 108° 11' 0	T3S R96W Sec 5 SE1/4, SE1/4, SE1/4	N 185,662 E 1,246,291	6460'
WU33	39° 47' 15" 108° 12' 34"	T3S R96W Sec 18 SE1/4, NE1/4, SW1/4	N 177,045 E 1,238,742	6860'
WU36	39° 49' 28" 108° 11' 54"	T3S R96W Sec 5 NE1/4, NW1/4, NW1/4	N 190,382 E 1,242,268	6380'
WU39	39° 49' 34" 108° 12' 27"	T2S R96W Sec 31 SW1/4, SW1/4, SE1/4	N 191,137 E 1,239,685	6380'
WU42	39° 50' 3" 108° 13' 13"	T2S R97W Sec 36 SE1/4, SE1/4, NE1/4	N 194,091 E 1,236,228	6430'
WU45	39°50'8" 108°13'14"	T2S R97W Sec 36 SE1/4, NE1/4		
WU50	39° 47' 43" 108° 13' 39"	T3S R97W Sec 13 NE1/4, NE1/4, NW1/4	N 180,000 E 1,233,714	6660'
WU52	39° 48' 49" 108° 14' 34"	T3S R97W Sec 2 NE1/4, SW1/4, SE1/4	N 186,857 E 1,229,685	6460'
WU58	39° 50' 12" 108° 14' 36"	T2S R97W Sec 35 NE1/4, SW1/4, NE1/4	N 195,222 E 1,229,748	6280'

* Plane Coordinate Projection Tables, Colorado, Special Publication No. 276, U.S. Government Printing Office.

\+ Multiple station codes at the same location indicates samples taken at different depths.

No. 276, U. S. Government Printing Office.

ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE+	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
WU61	39° 51' 3" 108° 15' 31"	T2S R97W Sec 27 NE1/4, SE1/4, NE1/4	N 220,502 E 1,225,600	6220'
WV01	39° 49' 26" 108° 16' 39"	T3S R97W Sec 4	OFF TRACT	6411'
WV02	39° 48' 35" 108° 08' 49"	T3S R96W Sec 10	OFF TRACT	6490'
WV03	39° 48' 00" 108° 05' 11"			
WV04	39° 09' 19" 108° 13' 28"	T4S R96W Sec 9	N 675,219 E 1,249,792	
WV05	39° 41' 53" 108° 05' 24"	T4S R95W Sec 18	OFF TRACT	7420'
WV06				
WV07			N 185,565 E 1,234,236	6794.8'
WV08			N 188,206 E 1,233,371	6704.1'
WV09			N 188,055 E 1,231,357	6692.7'
WV37	39° 48' 01" 108° 12' 42"	T3S R96W Sec 7 NE1/4, SW1/4	N 181,750 E 1,238,250	6909.0'
WV40	39° 48' 01" 108° 12' 14"	T3S R96W Sec 7 NE1/4, SW1/4	N 181,750 E 1,238,125	6909.0'
WW12	39° 48' 42" 108° 13' 29"	T3S R97W Sec 1 SE1/4, SW1/4, SE1/4	N 185,977 E 1,234,720	6780'
WW13	39° 47' 46" 108° 13' 05"		N 180,272 E 1,236,438	6953.6'
WW22	39° 48' 42" 108° 13' 29"	T3S R97W Sec 1 SE1/4, SW1/4, SE1/4	N 185,977 E 1,234,720	6764.0'
WW32		T3S R97W Sec 12	N 188,516 E 1,237,012	6785.0'

* Plane Coordinate Projection Tables, Colorado, Special Publication No. 276, U.S. Government Printing Office.

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ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE+	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
WX02	39° 48' 56" 108° 12' 22"	T3S R96W Sec 6 SE1/4, NW1/4, SE1/4	N 187,234 E 1,240,000	6730'
WX04	39° 47' 11" 108° 12' 4"	T3S R96W Sec 17 SE1/4, NW1/4, SW1/4	N 176,542 E 1,241,074	7040'
WX10	39° 47' 46" 108° 13' 06"	T3S R97W Sec 13 NE1/4, NE1/4, NE1/4	N 180,257 E 1,236,291	6950'
WX12/WY12	39° 48' 52" 108° 14' 36"	T3S R97W Sec 2 NE1/4, SW1/4, SE1/4	N 187,171 E 1,229,497	6440'
WX17/WY17	39° 46' 58" 108° 10' 51"	T3S R96W Sec 16 SW1/4, SW1/4, SW1/4	N 175,034 E 1,246,668	7040'
WX19	39° 49' 31" 108° 11' 59"	T3S R96W Sec 5 NW1/4, NW1/4, NW1/4	N 190,760 E 1,241,891	6370'
WX20	39° 49' 33" 108° 12' 24"	T2S R96W Sec 31 SE1/4, SW1/4, SE1/4	N 191,011 E 1,239,937	6350'
WX21	39° 48' 57" 108° 13' 24"	T3S R97W Sec 13 SE1/4, SW1/4, SE1/4	N 175,348 E 1,234,782	6870'
WX32	39° 48' 26" 108° 13' 36"	T3S R97W Sec 12 NW1/4, SW1/4, NE1/4	N 184,342 E 1,234,091	6840'
WX33	39° 49' 0" 108° 13' 28"	T3S R97W Sec 1 SE1/4, NW1/4, SE1/4	N 187,800 E 1,234,845	6720'
WX38	39° 48' 05" 108° 12' 40"	T3S R96W Sec 7 NE1/4, SW1/4	N 182,100 E 1,238,400	6909.0'
WX41	39° 49' 32" 108° 13' 08"		N 191,000 E 1,236,500	6460.0'
WX44/WY45 /WY46	39° 48' 1" 108° 12' 44"	T3S R96W Sec 7 SW1/4, NE1/4, SW1/4	N 181,765 E 1,238,114	6910'
WX55/WY52 /WY54	39° 47' 48" 108° 12' 7"	T3S R96W Sec 7 SE1/4, SE1/4, SE1/4	N 180,320 E 1,240,948	6900'
WX63/WY61 WY62	39° 48' 13" 108° 12' 32"	T3S R96W Sec 7 NW1/4, NW1/4, SE1/4	N 182,897 E 1,239,057	6870'

* Plane Coordinate Projection Tables, Colorado, Special Publication No. 276, U.S. Government Printing Office.

+ Multiple station codes at the same location indicates samples taken at different depths.

ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE+	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
WX64/WY64	39° 55' 16" 108° 13' 01"		OFF TRACT	7178.0'
WX65/WY65	39° 51' 36" 108° 21' 00"		OFF TRACT	6390.0'
WX67/WY67	39° 52' 55" 108° 15' 42"		OFF TRACT	6740.0'
WX69/WY69	39° 53' 10" 108° 05' 04"		OFF TRACT	7350.0'
WX71/WY71	39° 47' 47" 108° 21' 49"	T3S R98W Sec 11	OFF TRACT	6580.0'
WX72/WY72	39° 45' 40" 108° 19' 12"		OFF TRACT	6805.0'
WX73	41° 09' 26" 108° 08' 15"	T4S R95W Sec 32	N 675,219 E 1,273,792	8142.3'
WX74			OFF TRACT	
WX75	41° 08' 48" 108° 09' 03"	T5S R95W Sec 6	N 671,467.4 E 1,269,951.5	7583.2'
WX82	39° 48' 13" 108° 10' 13"		N 182,562 E 1,249,938	6909.0'
WX92/WY91	39° 47' 48" 108° 14' 20"	T3S R97W Sec 11 SE1/4, SE1/4, SE1/4	N 180,634 E 1,230,571	6870'
WY01	39° 48' 52" 108° 14' 3"	T3S R97W Sec 1 NE1/4, SW1/4, SW1/4	N 187,045 E 1,232,079	6780'
WY03	39° 48' 51" 108° 11' 29"	T3S R96W Sec 5 NW1/4, SW1/4, SE1/4	N 186,605 E 1,244,091	6740'
WY44	39° 48' 01" 108° 12' 44"		N 181,772 E 1,238,125	6909.0'
WY66	39° 50' 41" 108° 16' 04"	T2S R97W Sec 27	OFF TRACT	6286.0'
WY68	39° 45' 55" 108° 12' 31"		OFF TRACT	6840.0'

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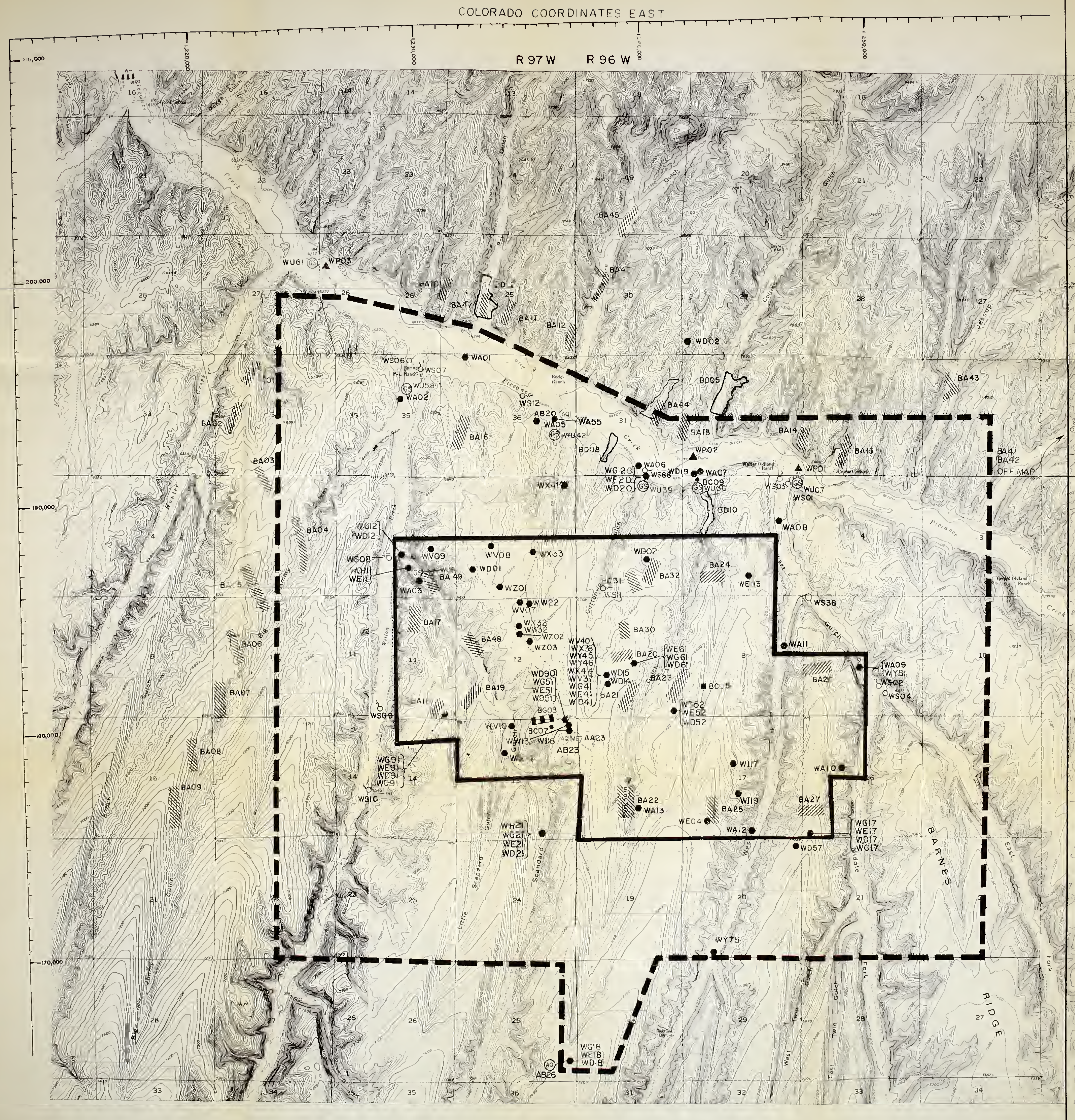
\+ Multiple station codes at the same location indicates samples taken at different depths.

ENVIRONMENTAL DATA COLLECTION STATION COORDINATES

STATION CODE+	LATITUDE & LONGITUDE	TOWNSHIP & RANGE	STATE COORDINATES*	ELEVATION
WY70	39° 45' 51"	T3S R99W Sec 26	OFF TRACT	7070.0'
WY71	108° 28' 01"	T4S R96W Sec 6	OFF TRACT	7145.0'
WY72	108° 12' 58"			
WY75	39° 45' 59"	T3S R96W Sec 29	N 169,250	6820.0'
	108° 21' 49"		E 1,242,500	7020.0'
	108° 25' 35"			
WY76	39° 45' 02"	T3S R96W Sec 33	OFF TRACT	6865.0'
	108° 10' 04"	T3S R96W Sec 9	N 182,457	6540'
	108° 10' 24"	NE1/4, NE1/4, SW1/4	E 1,249,057	
WY77	41° 08' 44"		N 672,812	7777.8'
	108° 21' 09"		E 1,214,479	6720'
	108° 13' 20"	SE1/4, NW1/4, SE1/4	E 1,235,461	
WY78	39° 43' 53"	T4S R96W Sec 6	OFF TRACT	7145.0'
	108° 12' 58"			
WY79	39° 51' 10"	T2S R98W Sec 30	OFF TRACT	7020.0'
	108° 25' 35"			
WY81	39° 48' 12"	T3S R96W Sec 9	N 182,457	6540'
	108° 10' 24"	NE1/4, NE1/4, SW1/4	E 1,249,057	
WZ01	39° 42' 02"	T3S R96W Sec 1	N 188,015	6720'
	108° 13' 20"	NE1/4, NW1/4, SE1/4	E 1,235,461	
WZ02	39° 48' 28"		N 184,592	
	108° 13' 27"		E 1,234,798	
WZ03	39° 48' 26"		N 184,306	
	108° 13' 28"		E 1,234,705	

* Plane Coordinate Projection Tables, Colorado, Special Publication No 276, U.S. Government Printing Office.

\+ Multiple station codes at the same location indicates samples taken at different depths.


COLORADO COORDINATES EAST
R 97 W
R 96 W
200,000
190,000
180,000
170,000
Piceance Creek
Hunter Creek
Willow Creek
Cottonwood Gulch
Stewart Gulch
Little Scandard Gulch
Scandard Gulch
West Fork
Middle Fork
East Fork
Twin Gulch
BARNES RIDGE
Jessup Gulch
Collins Gulch
Big Jimmy Gulch
Dry Fork
OFF MAP
BA41
BA42
WU61
WP03
WP02
WP01
WA01
WA02
WA03
WA05
WA06
WA07
WA08
WA09
WA10
WA11
WA12
WA13
WA55
WS03
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WS02
WS04
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WD61
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WY46
WY81
WY75
WZ01
WZ02
WZ03
WH21
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WI19
WE04
BA01
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BA19
BA20
BA21
BA22
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BA24
BA25
BA27
BA30
BA32
BA43
BA44
BA45
BA47
BA48
BA49
BD05
BD08
BD10
BC03
BC07
BC09
AB20
AB23
AB26
AA23

INTERIM MONITORING PROGRAM

July 8, 1982

GS Water Gaging Station

AQ Air Quality Station

Aquatic Sampling Site
PC—Piceance Creek

MET Meteorological Tower 200'

VO	Vegetotian Site	VO= Open (50 x 70 m)
VF		VF= Fenced (50x70m)

Micrenvionmental Stations

Well Hole Locations

Deer Pellet and Browse Utilization Transects

Deer Mortality Plots

5.1 Brush Beating Project: Vegetation Analysis

Vegetation sampling consisted of sampling herbaceous species for species frequency and annual production. Sampling was done along randomly located transect lines, one each in both gulches where beating occurred and one control transect (no brush beating). Each transect consisted of sampling 25 one-square-meter quadrats.

Frequency was determined for individual species encountered at each site. Mean annual production was determined for individual species as well as entire sites. Production was determined using a double sampling approach. The data and results are listed in Tables 5.1-1 through 5.1-10.

Mean herbaceous production for the brush beating sites was well above that of the control area. However, the difference between the beating sites and the control site was not as much in 1982 as the past two years (all sites had higher production values in 1982). Mean herbaceous production in Oldland Gulch was 69.38 g/m^2 (619 lbs/acre), Gardenhire Gulch production was 68.76 g/m^2 (613 lbs/acre), and in the Control site production was 38.38 g/m^2 (339 lbs/acre).

Species frequency was similar for both the beating sites and the control site.

5.2 Excess Mine Water Disposal - Land Application System Impacts

The sprinkler-irrigation system which was used to dispose of excess mine water during the late spring, summer and early fall of 1980 and 1981 was not used during 1982. However, the concentration and build-up of salts and specific ions in the soils and vegetation from the applied water of the two previous years does not necessarily disappear once irrigation ceases.

Therefore, a chemical analysis of the soils and vegetation was conducted in October, 1982 (end of the growing season) in order to determine the concentration levels of salts and ions in the soils and vegetation one year following irrigation.

Vegetation and soil samples were taken from the same treatment areas, were analyzed using the same methods, similar sampling period, and were analyzed for the same parameters as the two previous years.

Soil Chemical Properties

The soil parameters analyzed were pH, electrical conductivity (ECe), exchangeable sodium percentage (ESP), and Boron (B). Values for treatment, depth, and replications are presented in Tables 5.2-1 and 5.2-2. In order to determine what is happening with these parameters in the soil, concerning toxic concentrations, or continued build-up in soils, or decreasing concentrations in soils one year after irrigation has stopped, three questions were asked: 1) Are 1982 levels less than levels that could be considered toxic to plant growth?

TABLE 5.1-1 Fresh weight estimates (grams) for Oldland Gulch Brush Beating Area. 1982

Quadrat Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Agropyron cristatum		13				8	5	64			16	48	7	12	18					22	10			42	58
Agropyron dasystachyum						62					4														
Agropyron intermedium				22		2						3			14						8			30	14
Agropyron smithii	124	135	32	48	74	4			66	20		32	49	69	4	94	86	14	102			13	65		3
Artemisia ludoviciana	11										4										16	2		4	
Bromus tectorum	1	2	4	3		1	12	3	28	35	32	5	15	4	16	1	14	2	16	15	7	9	10	2	1
Chenopodium album	<1												<1			<1									
Collinsia parviflora					2																				
Descurainia pinnata		<1		1	5				2					1		<1	1	<1			<1				
Draba spp.													<1		6										
Elymus cinereus								28																22	
Elymus junceus											5	11	37	4	7									10	5
Erysimum asperum						21	1				5		3		2				4	2			3		
Lappula redowskii	<1								3	1			<1							<1			<1		
Medicago sativa														3											
Oryzopsis hymenoides		7				11	84	29				10	44			17			6	9	75	82	21	29	34
Poa spp.					2																				
Sitanion hystrix																						4			
Spharalcea coccinea																							3		
Sporobolus cryptandrus																		2							
Stipa comata		28	84	42												10	5	102							
Tragopogon dubius																		4							
TOTAL BIOMASS	136	185	120	116	83	109	102	124	99	56	66	109	155	93	57	122	106	124	128	48	116	110	102	139	115

TABLE 5.1-2 Fresh weight estimates (grams) for Gardenhire Gulch. 1982

Quadrat Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Agropyron cristatum			58				34							30	27			14						10	25
Agropyron dasystachyum		18	15																						
Agropyron smithii	87	144		32	45	21			18	39							96	10	65		105	116	32		35
Agropyron trachycaulum											72														
Artemisia frigida											48				32	25								20	18
Artemisia ludoviciana															9										
Aster spp.						1										2									
Bouteloua gracilis			2				4						12	2											
Bromus inermis							3																	6	
Bromus tectorum		11	25	4	28	3	11	18	3	8	16	35	32	44	35	6	15	12	7	18	4	7	4	48	19
Chenopodium album																							2		
Descurainia pinnata	<1		<1	1	<1					1												1	15		
Draba spp.						5																	18		
Erysimum asperum				2			10	4	4	2		14						2				5			2
Kochia spp.		<1				<1	1					<1	<1		<1										
Lappula redowskii									1	<1						1	<1								
Medicago sativa																	10								8
Oryzopsis hymenoides			17				8			42	12				9	14			15	20	12	5	62	54	10
Sitanion hystrix														5											
Sporobolus cryptandrus		28																							
Stipa comata	40		5	65	48	76		104	25	13		10	36						3	44					
TOTAL BIOMASS	127	201	122	104	121	106	71	126	51	105	148	59	80	81	112	48	121	38	90	82	121	134	133	138	11

TABLE 5.1-3 Fresh weight estimates (grams) for Brush Beating Control Area. 1982.

Quadrat Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Agropyron smithii						46	115		27	31		16	26	29		95	47	16	17	10		58	13		104
Artemisia frigida			12												10						2				4
Artemisia ludoviciana				14	12							9											6		10
Astragalus spp.									2																
Bouteloua gracilis																				7	4	2	3		
Chenopodium spp.						<1						<1													
Descurainia pinnata	<1					1	2			<1				<1			<1	<1	<1	<1					
Erysimum asperum	9					4	11																		
Lappula redowskii						<1	<1													<1					
Oryzopsis hymenoides	19	39	12	18	8			47	18	15	95	34	24				8				20		24	69	6
Senecio multilobatus																			4						
Sitanion hystrix		7								3									4						
Sporobolus cryptandrus													8						5						
Stipa comata					64	10		4	9					50	54		3		18	38					
Tragopogon dubius								3																	
Bromus tectorum	6	3	10	<1	<1	4	1		<1	6	1	5	8	<1	2	11		<1	17	3	7	9	2	12	<1
TOTAL BIOMAS	34	49	34	32	84	65	129	54	56	55	96	64	66	79	66	106	58	16	65	58	33	69	48	81	124

TABLE 5.1-4 Oven dry weight (grams) for Oldland Gulch brush beating area. 1982

Species	Quadrat Numbers 1	6	13	16	24			
Agropyron cristatum	-	1.89	3.66	-	30.38			
Agropyron dasystachyum	-	36.49	-	-	-			
Agropyron intermedium	-	0.85	-	-	20.52			
Agropyron smithii	80.26	5.33	24.03	47.69	-			
Artemisia ludoviciana	3.03	-	-	-	0.96			
Bromus tectorum	0.19	0.33	19.21	0.58	2.30			
Chenopodium album	0.03	-	0.07	0.02	-			
Collinsia parviflora	-	-	-	-	-			
Descurainia pinnata	-	-	-	0.04	-			
Draba spp.	-	-	0.04	-	-			
Elymus cinereus	-	-	-	-	15.10			
Elymus junceus	-	-	12.25	-	6.26			
Erysimum asperum	-	15.08	0.77	-	-			
Lappula redowskii	0.03	-	0.04	-	-			
Medicago sativa	-	-	-	-	-			
Oryzopsis hymenoides	-	11.35	32.32	7.95	22.02			
Poa spp.	-	-	-	-	-			
Sitanion hystrix	-	-	-	-	-			
Sphaeralcea coccinea	-	-	-	-	-			
Sporobolus cryptandrus	-	-	-	-	-			
Stipa comata	-	-	-	6.53	-			
Tragopogan dubius	-	-	-	-	-			
TOTAL BIOMASS	83.54	71.32	92.39	62.81	97.54			

TABLE 5.1-5 Oven dry weight (grams/m^2) for Gardenhire Gulch brush beating area. 1982

Species	Quadrat Numbers 1	2	3	11	19			
Agropyron cristatum	-	-	42.75	-	-			
Agropyron dasystachyum	-	7.44	7.15	-	-			
Agropyron smithii	55.17	95.84	3.49	-	32.59			
Agropyron trachycaulum	-	-	-	52.33	-			
Artemisia frigida	-	-	-	11.48	-			
Aster spp.	-	-	-	-	-			
Bouteloua gracilis	-	-	0.48	-	-			
Bromus inermis	-	-	-	-	-			
Bromus tectorum	-	5.26	33.31	9.43	11.47			
Salsola	0.02	0.02	0.02	-	-			
Descurainia pinnata	0.02	-	0.05	-	-			
Draba spp.	-	-	-	-	-			
Erysimum asperum	-	-	-	-	-			
Kochia spp.	-	0.02	-	-	-			
Lappula redowskii	-	-	-	-	-			
Medicago sativa	-	-	-	-	-			
Oryzopsis hymenoides	-	-	10.53	5.44	8.46			
Sitanion hystrix	-	-	-	-	-			
Sporobolus cryptandrus	-	12.59	-	-	-			
Stipa comata	35.22	-	3.17	-	-			
TOTAL BIOMASS	90.43	121.17	100.95	78.68	52.52			

TABLE 5.1-6 Oven dry weight (grams/m^2) for Brush Beating Control Area. 1982

Species	Quadrat Numbers 1	6	11	14	21			
Agropyron smithii	-	23.41	-	12.64	-			
Artemisia frigida	-	-	-	-	0.24			
Artemisia ludoviciana	-	-	-	-	-			
Astragalus spp.	-	-	-	-	-			
Bouteloua gracilis	-	-	-	-	1.53			
Bromus tectorum	4.08	3.04	0.56	0.04	6.60			
Chenopodium album	-	0.02	-	-	-			
Descurainia pinnata	0.04	0.22	-	0.02	-			
Erysimum asperum	4.77	1.88	-	-	-			
Lappula redowskii	-	0.04	-	-	-			
Oryzopsis hymenoides	13.22	-	55.27	-	14.27			
Senecio multilobatus	-	-	-	-	-			
Sitanion hystrix	-	-	-	-	-			
Sporobolus cryptandrus	-	-	-	-	-			
Stipa comata	-	3.58	-	22.58	-			
Tragopogan dubius	-	-	-	-	-			
TOTAL BIOMASS	22.11	32.19	55.83	35.28	22.64			

TABLE 5.1-7 Regression Equations for converting fresh weight estimates to oven dry weights for Brush Beating and Control Areas. 1982

Species	Regression Equation	Correlation Coefficient
Agropyron cristatum	y = 0.79x - 3.13	0.99
Agropyron Dasystachyum	y = 0.64x - 3.24	0.99
Agropyron intermedium	y = 0.70x - 0.55	1.00
Agropyron smithii	y = 0.67x - 5.79	0.98
Artemisia frigida	y = 0.24x + 0.03	0.99
Bouteloua gracilis	y = 0.52x - 0.57	1.00
Bromus tectorum	y = 1.17x - 1.19	0.92
Chenopodium album Descurainia pinnata	y = 0.21x + 0.01	0.99
Elymus junceus	y = 0.20x + 6.49	0.61
Erysimum asperum	y = 0.79x - 1.66	0.99
Lappula redowskii Oryzopsis hymenoides	y = 0.59x + 1.24	0.98
Stipa comata	y = 0.61x + 0.25	0.88

Due to insufficient data for some species, it is not possible to calculate regression equations for those species, therefore, the following applies for converting fresh estimated weights to oven dry weights:

- Artemisia frigida and A. ludoviciana data were pooled together to calculate a regression equation for both species. This was also done for Elymus cinereus and E. junceus.
- The regression equation for Descurainia pinnata was used as a conversion for Chenopodium album, Collinsia parviflora, Kochia spp, and Lappula redowskii.
- The regression equation for Agropyron cristatum was used as a conversion for Sitanion hystrix.
- The regression equation for Artemisia frigida was used as a conversion for Aster spp., Medicago sativa, Astragalus spp., Senecio multilobatus, Sphaeralcea coccinea, and Tragapogon dubius.
- The regression equation for Bromus tectorum was used as a conversion for Poa spp.
- The regression equation for Stipa comata was used as a conversion for Bromus inermis.
- The regression equation for Oryzopsis hymenoides was used as a conversion for sporobolus cryptandrus.
- The regression equation for Erysimum asperum was used as a conversion for Draba spp.

TABLE 5.1-8 Mean production ± the standard error of the mean (S.E.), frequency, and range of observed values for quadrats in Oldland Brush Beating Area, 1982. Based on data derived from regression equations. Production values in grams/meter^2.

Species	Mean ± S.E.	Sample Size	Frequency (%)	Range of Values
Agropyron cristatum	8.62 ± 2.87	25	52	0 - 47.62
Agropyron dasystachyum	1.46 ± 1.46	25	8	0 - 36.44
Agropyron intermedium	2.46 ± 1.07	25	28	0 - 20.52
Agropyron smithii	23.65 ± 5.37	25	76	0 - 84.43
Artemisia ludoviciana	0.36 ± 0.19	25	20	0 - 3.87
Bromus tectorum	9.96 ± 2.32	25	96	0 - 39.61
Chenopodium album	0.005 ± 0.003	25	12	0 - 0.07
Collinsia parviflora	0.017 ± 0.017	25	4	0 - 0.43
Descurainia pinnata	0.09 ± 0.05	25	36	0 - 1.05
Draba spp.	0.12 ± 0.12	25	8	0 - 3.08
Elymus cinereus	0.93 ± 0.64	25	8	0 - 12.23
Elymus junceus	2.46 ± 0.84	25	28	0 - 14.07
Erysimum asperum	0.80 ± 0.60	25	32	0 - 14.88
Lappula redowskii	0.04 ± 0.03	25	24	0 - 0.64
Medicago sativa	0.03 ± 0.03	25	4	0 - 0.75
Oryzopsis hymenoides	11.57 ± 3.23	25	56	0 - 51.10
Poa spp.	0.046 ± 0.046	25	4	0 - 1.15
Sitanion hystrix	0.001 ± 0.001	25	4	0 - 0.03
Sphaeralcea coccinea	0.03 ± 0.03	25	4	0 - 1.18
Sporobolus cryptandrus	0.05 ± 0.05	25	4	0 - 0.03
Stipa comata	6.64 ± 3.27	25	24	0 - 62.18
Tragopogon dubius	0.04 ± 0.04	25	4	0 - 0.99
TOTAL	69.38 ± 3.30	25		37.30 - 115.43
Number of Species/m^2	5.36 ± 0.28			3 - 9

TABLE 5.1-9 Mean production ± the standard error of the mean (S.E.), frequency, and range of observed values for quadrats in Gardenhire Gulch Brush Beating Area, 1982. Based on data derived from regression equations. Production values in grams/meter^2.

Species	Mean ± S.E.	Sample Size	Frequency (%)	Range of Values
Agropyron cristatum	5.40 ± 2.16	25	28	0 - 42.86
Agropyron dasystachyum	0.59 ± 0.41	25	8	0 - 8.28
Agropyron smithii	19.35 ± 5.41	25	70	0 - 90.44
Agropyron trachycaulum	2.09 ± 2.09	25	4	0 - 52.33
Artemisia frigida	1.38 ± 0.61	25	20	0 - 11.55
Artemisia ludoviciana	0.09 ± 0.09	25	4	0 - 2.19
Aster spp.	0.03 ± 0.02	25	8	0 - 0.51
Bouteloua gracilis	0.33 ± 0.23	25	16	0 - 5.73
Bromus inermis	0.24 ± 0.17	25	8	0 - 3.91
Bromus tectorum	18.11 ± 3.16	25	96	0 - 54.77
Chenopodium album	0.017 ± 0.017	25	4	0 - 0.43
Descurainia pinnata	0.15 ± 0.12	25	28	0 - 3.11
Draba spp.	0.59 ± 0.51	25	8	0 - 12.56
Erysimum asperum	0.84 ± 0.44	25	36	0 - 6.22
Kochia spp.	0.013 ± 0.009	25	24	0 - 0.22
Lappula redowskii	0.018 ± 0.012	25	16	0 - 0.22
Medicago sativa	0.18 ± 0.12	25	8	0 - 2.43
Oryzopsis hymenoides	7.29 ± 2.13	25	52	0 - 38.04
Sitanion hystrix	0.03 ± 0.03	25	4	0 - 0.82
Sporobolus cryptandrus	0.50 ± 0.50	25	4	0 - 12.59
Stipa comata	11.51 ± 3.53	25	48	0 - 63.39
TOTAL	68.76 ± 4.70	25	100	21.69 - 122.96
Number of Species/m^2	4.80 ± 0.26			3 - 7

TABLE 5.1-10 Mean production $\pm$ the standard error of the mean (S.E.), frequency, and range of observed values for quadrats in the Control Area (for comparison to brush beating areas), 1982. Based on data derived from regression equations. Production in grams/meter^2.

Species	Mean + S.E.	Sample Size	Frequency (%)	Range of Values
Agropyron smithii	13.90 $\pm$ 4.23	25	60	0 - 71.07
Artemisia frigida	0.27 $\pm$ 0.15	25	16	0 - 2.91
Artemisia ludoviciana	0.50 $\pm$ 0.21	25	20	0 - 3.39
Astragalus spp.	0.02 $\pm$ 0.02	25	4	0 - 0.51
Bouteloua gracilis	0.24 $\pm$ 0.14	25	16	0 - 3.10
Bromus tectorum	4.19 $\pm$ 1.03	25	92	0 - 18.63
Chenopodium album	0.002 $\pm$ 0.002	25	8	0 - 0.02
Descurainia pinnata	0.03 $\pm$ 0.02	25	36	0 - 0.43
Erysimum asperum	0.55 $\pm$ 0.35	25	12	0 - 7.00
Lappula redowskii	0.003 $\pm$ 0.002	25	12	0 - 0.04
Oryzopsis hymenoides	11.62 $\pm$ 2.88	25	64	0 - 57.63
Senecio multilobatus	0.04 $\pm$ 0.04	25	4	0 - 0.99
Sitanion hystrix	0.10 $\pm$ 0.09	25	12	0 - 2.40
Sporobolus cryptandrus	0.41 $\pm$ 0.29	25	8	0 - 5.96
Stipa comata	6.16 $\pm$ 2.37	25	36	0 - 39.11
Tragopogon dubius	0.03 $\pm$ 0.03	25	4	0 - 0.75
TOTAL	38.08 $\pm$ 3.53	25	100	5.98 - 78.54
Number of Species/m^2	4.04 $\pm$ 0.30			2 - 7

TABLE 5.2-1 Values of pH and electrical conductivity (ECe) from soils samples taken June and December 1980, October 1981 and October 1982.

Treatment # and Replication #	Depth Interval in Feet	pH (log [H]) June	Dec	Oct'81	Oct'82	ECe (mmhos / cm) June	Dec	Oct'81	Oct'82
5a 1	0-1	8.0	8.3	8.6	7.8	0.6	0.9	1.9	1.6
	1-2	7.9	- -	8.7	7.9	0.8	- -	1.0	1.5
5a 2	0-1	7.8	8.4	8.5	8.2	0.9	1.1	2.2	1.4
	1-2	7.7	- -	8.3	8.0	1.0	- -	1.8	1.4
5a 3	0-1	7.6	8.5	8.7	8.0	1.2	1.1	1.8	1.8
	1-1.5	8.0	- -	8.6	7.9	1.0	1.4	1.7	1.5
5a 4	0-1	7.5	8.2	8.8	8.0	1.0	1.4	1.7	1.9
	1-2	8.0	- -	- -	7.9	0.5	- -	- -	1.1
5b 1	0-1	7.9	8.2	8.5	7.9	0.6	0.8	1.3	1.2
	1-2	7.7	- -	8.4	7.9	0.8	- -	0.8	1.2
	2-2.5	8.2	- -	8.4	7.9	0.6	- -	- -	0.96
5b 2	0-1	7.5	8.5	8.7	7.9	1.4	1.0	1.31	1.6
	1-2	- -	- -	8.2	8.1	- -	- -	1.2	1.5
5b 3	0-1	7.9	8.3	8.8	8.1	0.9	0.7	1.1	1.6
	1-2	7.9	- -	8.5	7.7	0.7	- -	0.8	1.4
	2-2.5	7.7	- -	- -	7.6	1.0	- -	- -	1.3
5b 4	0-1	7.8	8.2	8.7	8.1	0.5	0.7	1.1	1.2
	1-2	7.9	- -	8.5	7.8	0.6	- -	0.7	1.0
	2-2.5	8.3	- -	- -	7.6	0.6	- -	- -	0.84
5c 1	0-1	7.5	8.3	8.7	8.1	0.4	1.0	0.7	0.70
	1-2	7.8	- -	8.3	7.4	0.4	- -	0.7	0.56
5c 2	0-1	6.9	8.1	8.6	7.9	0.4	0.5	0.9	1.1
	1-2	7.6	- -	8.2	7.7	0.3	- -	0.8	0.58
5c 3	0-1	7.3	8.0	8.2	8.0	0.5	0.4	0.8	0.74
	1-2	7.8	- -	8.4	7.8	0.4	- -	1.0	0.78
5c 4	0-1	7.5	8.3	8.4	8.0	0.4	2.2	0.8	0.74
	1-2	7.9	- -	8.4	7.9	0.4	- -	0.7	0.69

TABLE 5.2-1 Values of pH and electrical conductivity (ECe) (Continued)

Treatment # and Replication #	Depth Interval in Feet	pH (log [H]) June	Dec	Oct'81	Oct'82	ECe (mmhos / cm) June	Dec	Oct'81	Oct'82
7c 1	0-1	7.9	8.7	8.6	8.0	0.4	0.5	1.0	0.92
	1-1.5	7.7	- -	8.6	7.8	0.5	- -	1.1	0.74
7c 2	0-1	7.7	- -	8.6	8.0	0.5	- -	0.9	1.3
	1-1.5	7.7	- -	- -	7.7	0.8	- -	- -	3.4
7c 3	0-1	7.7	- -	8.6	7.7	0.8	- -	1.0	7.2
	1-2	8.5	- -	- -	7.8	1.7	- -	- -	9.2
7c 4	0-1	8.3	8.4	8.9	8.1	0.7	0.5	0.9	1.4
	1-2	8.6	- -	- -	7.6	1.5	- -	- -	1.2
Control 1	0-1	- -	- -	8.0	7.7	- -	- -	0.5	0.86
Control 2	0-1	- -	- -	7.7	7.6	- -	- -	0.8	0.66
	1-2	- -	- -	8.0	7.6	- -	- -	0.4	0.56
Control 3	0-1	- -	- -	7.9	7.4	- -	- -	0.7	0.56
	1-2	- -	- -	8.2	7.5	- -	- -	0.3	0.52
Control 4	0-1	- -	- -	8.0	7.5	- -	- -	1.1	0.54
	1-2	- -	- -	8.5	7.6	- -	- -	0.7	0.42

TABLE 5.2-2 Values of exchangeable sodium percentage (ESP), and boron (ppm) from soils samples taken June and December 1980, October 1981, and October 1982.

Treatment # and Replication #	Depth Interval in Feet	ESP (%) June	ESP (%) Dec	ESP (%) Oct'81	ESP (%) Oct'82	Boron (ppm) June	Boron (ppm) Dec	Boron (ppm) Oct'81	Boron (ppm) Oct'82
5a 1	0-1	<1	6	14	17	0.38	0.41	0.3	1.4
	1-2	<1	--	5	12	0.50	--	0.1	1.1
5a 2	0-1	<1	7	13	16	0.74	0.47	*	2.9
	1-2	<1	--	8	13	0.74	--	*	1.5
5a 3	0-1	<1	11	15	12	1.04	0.46	*	2.0
	1-1.5	<1	--	15	12	0.63	--	*	1.1
5a 4	0-1	<1	8	9	12	1.00	2.16	*	2.1
	1-2	<1	--	--	7.9	0.50	--	--	1.3
5b 1	0-1	<1	8	11	15	0.52	0.19	--	2.0
	1-2	<1	--	4	13	0.57	--	0.1	0.6
	2-2.5	<1	--	3	12	0.34	--	0.1	0.8
5b 2	0-1	<1	8	11	66	2.01	0.86	--	2.5
	1-2	--	--	2	15	--	--	--	1.5
5b 3	0-1	<1	5	9	16	1.20	0.17	*	2.2
	1-2	<1	--	4	5.6	0.62	--	0.1	1.4
	2-2.5	<1	--	--	2.0	1.36	--	--	1.5
5b 4	0-1	<1	3	9	15	0.51	0.16	0.3	1.9
	1-2	<1	--	2	10	0.67	--	0.1	1.1
	2-2.5	<1	--	--	6.0	0.55	--	--	0.9
5c 1	0-1	<1	10	7	8.3	0.28	1.63	<0.1	0.7
	1-2	<1	--	3	2.2	0.23	--	<0.1	0.4
5c 2	0-1	<1	2	7	12	0.44	0.10	0.2	1.5
	1-2	<1	--	2	3.8	0.27	--	0.1	0.6
5c 3	0-1	<1	3	6	7.8	0.39	0.08	1.0	0.8
	1-2	<1	--	3	3.2	0.29	--	0.2	0.6
5c 4	0-1	<1	8	7	9.1	0.20	1.37	0.2	0.8
	1-2	<1	--	1	4.5	0.24	--	<0.1	0.6

TABLE 5.2-2 Values of exchangeable sodium percentage (ESP), and boron (ppm) from soil samples. (Continued)

Treatment # and Replication #	Depth Interval in Feet	ESP (%) June	Dec	Oct'81	Oct'82	Boron (ppm) June	Dec	Oct'81	Oct'82
7c 1	0-1	<1	7	7	7.8	0.54	0.33	0.7	0.8
	1-1.5	<1	--	3	5.2	0.62	--	0.4	0.7
7c 2	0-1	<1	--	5	9.1	0.57	--	0.7	1.5
	1-1.5	<1	--	--	12	0.78	--	--	2.8
7c 3	0-1	<1	--	6	8.4	0.74	--	0.9	3.6
	1-2	15	--	--	25	4.43	--	--	5.7
7c 4	0-1	4	2	8	14	0.80	0.10	--	1.6
	1-2	12	--	--	7.2	1.44	--	--	1.2
Control 1	0-1	--	--	<1	5.4	--	--	< 0.1	1.1
Control 2	0-1	--	--	<1	3.9	--	--	< 0.1	1.2
	1-2	--	--	<1	1.4	--	--	< 0.1	0.9
Control 3	0-1	--	--	1	1.2	--	--	< 0.1	0.8
	1-2	--	--	<1	1.4	--	--	< 0.1	0.8
Control 4	0-1	--	--	6	1.9	--	--	< 0.1	0.5
	1-2	--	--	3	1.1	--	--	< 0.1	1.1

*Colored extract could not analyze for boron.

Soil toxicity levels for each parameter are listed in Table 5.2-3. 2) Are 1982 levels less than 1981 levels? Since irrigation has ceased for a year, the levels would be expected to decrease. 3) Is there a difference between the 1982 levels of the treatment plots and the control plots? When treatment areas are compared to control areas for the same year some control over the environmental variability (such as climatic conditions) is achieved. When post-treatment levels are compared to pre-treatment levels there is no control over environmental variability. No comparison of post-irrigation to pre-irrigation levels was done. The 1982 levels which were significantly less than toxic levels, significantly less than 1981 levels, and treatment levels which were significantly different from control levels are presented in Table 5.2-4.

Results of the soil sample analysis are as follows:

-pH: The 1982 levels for all treatments are significantly less than the level which may impede plant growth (9.0). The 1982 levels are also significantly less than 1981 levels. The 1982 treatment levels generally are significantly different (higher) than 1982 control levels.

-ECe: The 1982 levels for all treatments, with the exception of Treatment #7c, are significantly less than the level which may cause a slight yield reduction in the more sensitive forage crops (2.0 mmhos/cm). None of the 1982 levels are significantly less than the 1981 levels, in fact, in most cases there is a slight increase in the ECe from '81 to '82. Treatments 5a, 5b, and 7c are significantly different (higher) than the control area for the same depth intervals. Treatment 5c is not significantly different.

-ESP The 1982 levels are significantly less than the level considered to be at the range at which moderately tolerant crops can grow with little or no loss in production (20%). The 1982 levels are the highest recorded of four sampling periods. All treatments are significantly different (higher) than the control area.

-Boron: The 1982 levels, with the exception of the top foot from treatments 5a and 5b and both depths of treatment 7c, are significantly less than the level which can cause damage to sensitive crops (2.0 ppm). The 1982 levels are the highest recorded. About half the treatments and depths are not significantly different than the control area.

Chemistry of the Vegetation

The specific ions which are of concern in the vegetation and were analyzed are fluoride (F), boron (B), and sodium (Na). Three species of vegetation were sampled, including indian ricegrass (*Oryzopsis hymenoides*), western wheatgrass (*Agropyron smithii*), and big sagebrush (*Artemisia tridentata*). The 1982 foliar concentrations of F, B, and Na for each of these species are listed in Tables 5.2-5 through 5.2-7; comparisons with 1980 and 1981 are given in Tables 5.2-8 to -10. Here, as with the soils, three questions were asked about the 1982 data concerning the ion concentration levels in the foliage following irrigation: 1) Are 1982 concentrations less than concentrations that might be considered toxic for plant and/or toxic to herbivores grazing in the area? 2) Are 1982 concentrations different than 1981 concentrations? With the vegetation we are interested in knowing if the ion concentrations have increased or decreased from the previous year.

TABLE 5.2-3 Soil toxicity levels for pH, electrical conductivity (Ece), Boron, and exchangeable sodium percentage (ESP).

--pH: Soil pH less than 9.0 is considered suitable for plant growth. A pH greater than 9.0 may impede plant growth (Buckman, H.O., and N.C. Brady. 1969. The Nature and Properties of Soils. Macmillan Co., New York, N.Y. 653p.).

--ECe: ECe of less than or equal to 2.0 mmhos/cm may cause a slight yield reduction only in the more sensitive forage crops (Mass, E.V. and G.J. Hoffman. 1977. Crop Salt Tolerance--Current Assessment. J. Irrig. and Drainage Div., Amer. Soc. Civil Engr. 00: 115-134). Therefore the limit for ECe of this report is 2.0 mmhos/cm.

--Boron: Boron concentrations greater than or equal to 2.0 ppm can cause damage to sensitive crops (Maas and Hoffman, 1977).

--ESP: Moderately tolerant crops can grow with little or no loss in production in soils which have an ESP of 20-40. This is also the level where physical structure of the soils are too poor for good crop production (Ayers, R.S. and D.W. Westcot. 1976. Water Quality for Agriculture. Irrigation and Drainage Paper No. 29. Food and Agriculture Organization of the U.N. Publication. 97p.). Therefore the toxicity limit for ESP is set at 20%.

TABLE 5.2-4 Average of pH, electrical conductivity (ECe), exchangeable sodium percentage (ESP), and Boron of soil samples taken June and December 1980, October 1981, and October 1982.

Treatment Number	Depth (ft)	pH				ECe (mmhos/cm)				ESP (%)				Boron (ppm)			
		Jun80	Dec80	Oct81	Oct82	Jun80	Dec80	Oct81	Oct82	Jun80	Dec80	Oct81	Oct82	Jun80	Dec80	Oct81	Oct82
5a	0-1	7.7	8.4	8.7	8.0[abc]	1.0	1.1	1.9	1.7[ac]	<1	8.0	12.8	14.2[ac]	0.8	0.9	0.3	2.1[c]
	1-2	---	---	8.5	7.9[abc]	0.7	---	1.4	1.4[ac]	<1	---	9.3	11.2[ac]	0.6	---	<0.1	1.2[ac]
5b	0-1	7.8	8.3	8.7	8.0[abc]	0.9	0.8	1.2	1.4[ac]	<1	6.0	10.0	15.3[ac]	1.1	0.4	0.3	2.1[c]
	1-2	7.8	---	8.4	7.9[abc]	0.7	---	0.9	1.3[ac]	<1	---	3.0	10.9[ac]	0.6	---	<0.1	1.1[a]
	2-2.5	8.1	---	8.4	7.7[ab]	0.7	---	0.9	1.0[a]	<1	---	3.0	6.7[a]	0.8	---	---	1.1[a]
5c	0-1	7.3	8.2	8.5	8.0[abc]	0.4	1.0	0.8	0.8[a]	<1	5.8	6.8	9.3[ac]	0.3	0.8	0.5	0.9[a]
	1-2	7.8	---	8.3	7.7[ab]	0.4	---	0.8	0.7[a]	<1	---	2.3	3.4[ac]	0.3	---	0.2	0.5[ac]
7c	0-1	7.9	8.4	8.7	7.9[abc]	0.6	0.6	1.0	2.7	1.8	7.8	6.5	9.8[ac]	0.7	0.6	0.8	1.9
	1-2	8.1	---	8.6	7.7[ab]	1.1	---	1.1	2.9	7.3	---	3.0	12.3	1.8	---	0.4	2.6[c]
Control	0-1	---	---	7.9	7.5[ab]	---	---	0.8	0.7[a]	---	---	1.8	3.1[a]	---	---	<0.1	0.9[a]
	1.2	---	---	8.2	7.6[ab]	---	---	0.5	0.5[a]	---	---	1.0	1.3	---	---	<0.1	0.9[a]

[a]1982 levels followed by an "a" are significantly less than toxic levels of respective parameter at $\alpha=0.05$ using the t Test

[b]1982 levels followed by a "b" are significantly less than respective 1981 levels at $\alpha=0.05$ using the t Test.

[c]1982 Treatment levels followed by a "c" are significantly different than 1982 Control levels for same depths and parameters at $\alpha=0.05$ using the t Test.

TABLE 5.2-5 Foliar concentration of Boron, Sodium, and Fluoride in Indian ricegrass (Oryzopsis hymenoides). October, 1982.

Treatment and Replication		Boron (ppm)	Sodium (ppm)	Fluoride (ppm)
5b	1	29	860	< 20
	2	11	430	< 20
	3	40	110	< 20
	4	27	990	< 20
	5	42	2000	< 20
6b	1	31	2200	< 20
	2	25	540	< 20
	3	28	3800	< 20
	4	11	2200	< 20
	5	<10	1900	< 20
7c	1	11	1100	< 20
	2	11	1400	< 20
	3	14	1800	< 20
	4	13	2400	< 20
	5	16	1000	< 20
Control	1	19	290	< 20
	2	11	150	< 20
	3	10	620	< 20
	4	12	360	< 20
	5	13	72	< 20

TABLE 5.2-6 Foliar concentration of Boron, Sodium, and Fluoride in Western Wheatgrass (Agropyron smithii). October, 1982.

Treatment and Replication		Boron (ppm)	Sodium (ppm)	Fluoride (ppm)
5b	1	28	190	<20
	2	11	230	<20
	3	24	420	<20
	4	24	320	<20
	5	30	130	<20
6b	1	25	200	<20
	2	17	290	<20
	3	23	200	<20
	4	10	260	<20
	5	11	250	<20
7c	1	12	980	<20
	2	11	1100	<20
	3	10	610	<20
	4	<10	560	<20
	5	10	590	<20
8b	1	19	130	<20
	2	<10	180	<20
	3	10	240	<20
	4	13	140	<20
	5	18	160	<20
Control	1	12	107	<20
	2	<10	45	<20
	3	18	200	<20
	4	15	230	<20
	5	13	56	<20

TABLE 5.2-7 Foliar concentrations of Boron, Sodium, and Fluoride in Big Sagebrush (<u>Artemisia tridentata</u>). October, 1982.

Treatment and Replication		Boron (ppm)	Sodium (ppm)	Fluoride (ppm)
5b	1	49	140	<20
	2	43	130	<20
	3	43	140	<20
	4	51	140	<20
	5	34	110	<20
6b	1	40	240	<20
	2	35	95	<20
	3	38	380	<20
	4	48	150	<20
	5	26	270	<20
7c	1	25	480	<20
	2	42	160	<20
	3	20	-	<20
	4	24	620	<20
	5	52	58	<20
8b	1	35	130	<20
	2	47	110	<20
	3	43	100	<20
	4	46	240	<20
	5	38	140	<20
Control	1	29	180	<20
	2	36	92	<20
	3	23	180	<20
	4	38	250	<20
	5	48	83	<20

TABLE 5.2-8 Average fluoride (F) concentrations in foliage of *Oryzopsis hymenoides*, *Agropyron smithii*, and *Artemisia tridentata* at the end of growing seasons 1980, 1981, and 1982.

Species	Treatment #	Fluoride (ppm) 1980	1981	1982[a]
Oryzopsis hymenoides	5b	10.5	22.3	<20
	6b	39.5	42.0	<20
	7c	45.7	53.8	<20
	8b	--	--	--
	control	--	17.0	<20
Agropyron smithii	5b	27.6	19.0	<20
	6b	41.4	22.9	<20
	7c	45.0	38.4	<20
	8b	32.2	26.9	<20
	control	--	23.8	<20
Artemisia tridentata	5b	8.8	13.2	<20
	6b	16.4	24.3	<20
	7c	18.0	26.9	<20
	8b	8.6	16.7	<20
	control	--	10.4	<20

[a]Fluoride toxicosis has been observed in livestock grazing western wheatgrass containing 60 ppm fluoride. (Shupe, J.L., H.B. Peterson, Arland E. Olsen, and Gene W. Miller. 1978. Effects of poisonous plants on livestock. Academic Press, Inc. New York, New York. 40 p.) Therefore, 60 ppm F is considered as the toxic concentration for fluoride in the foliage. There are several factors which influence fluoride toxicosis in grazing livestock, for more information refer to the 1981 C.B. ANNUAL REPORT VOL. 2 section 8.11.3.5. The 1982 concentrations of fluoride are well below the toxic concentration. Therefore no fluoride toxicosis would be expected in grazing animals from the irrigation area during the 1982 growing season.

TABLE 5.2-9 Average boron (B) concentrations in foliage of *Oryzopsis hymenoides*, *Agropyron smithii*, and *Artemisia tridentata* at the end of growing seasons 1980, 1981, and 1982.

Species	Treatment#	Boron (ppm) 1980	1981	1982
Oryzopsis hymenoides	5b	48.03	2.1	29.80[ac]
	6b	86.10	2.1	23.75[ac]
	7c	41.40	2.1	13.00[ab]
	8b	--	--	--
	control	--	2.1	13.00[a]
Agropyron smithii	5b	40.40	2.5	23.40[a]
	6b	47.90	2.1	19.00[a]
	7c	36.75	5.5	10.75[abc]
	8b	41.40	2.7	15.00[a]
	control	--	2.2	14.50[a]
Artemisia tridentata	5b	113.00	87.6	44.00[ab]
	6b	106.80	45.7	37.40[ab]
	7c	138.40	48.6	32.60[ab]
	8b	101.60	70.6	41.80[ab]
	control	--	21.6	34.80[a]

[a] 1982 concentrations were compared with known toxic concentration of B in plant foliage -- <250 ppm B causes boron leaf toxicity: Richards, L. A. (Editor). 1954. "Diagnosis and Improvements of Saline and Alkali Soils" USDA Agricultural Handbook No. 60. Those values having an "a" are significantly below toxic concentrations at α=0.05 using the t Test.

[b] 1982 concentrations were compared to 1980 concentrations (1891 values for B in *O. hymenoides* and *A. smithii* are suspect because of such low values) in order to determine if 1982 concentrations of B in foliage has changed significantly since irrigation has ceased. 1982 values having a "b" are significantly different than 1980 at α=0.05 using the t Test.

[c] 1982 values of the treatment areas were compared to 1982 values in the control areas for same species in order to determine if the concentrations of B were significantly different between the treatment areas and the control area for the same year. 1982 treatment values having a "c" are significantly different than those in the control for same species at α=0.05 using the t Test.

TABLE 5.2-10 Average sodium (Na) concentrations in foliage of *Oryzopsis hymenoides*, *Agropyron smithii*, *Artemisia tridentata*, at the end of growing seasons 1980, 1981, and 1982.

Species	Treatment #	Sodium (ppm) 1980	1981	1982
Oryzopsis hymenoides	5b	657.0	1628.3	878.0[a]
	6b	595.8	2186.6	2128.0[c]
	7c	661.5	1784.7	1540.0[ac]
	8b	--	--	--
	control	--	475.2	298.4[a]
Agropyron smithii	5b	455.1	354.4	258.0[a]
	6b	517.5	365.4	240.0[abc]
	7c	713.3	436.6	768.0[abc]
	8b	444.1	390.8	170.0[ab]
	control	--	212.8	127.6[a]
Artemisia tridentata	5b	663.5	214.7	132.0[a]
	6b	573.2	392.0	227.0[a]
	7c	1099.2	635.3	329.5[a]
	8b	803.4	157.4	144.0[a]
	control	--	57.9	157.0[a]

[a]1982 concentrations were compared with known toxic concentrations of sodium in plant foliage which was found to be 10-30 meq NaCl per 100 grams or 2300-6900 ppm Na for sensitive plants (Ehlig, C.F. and L. Bernstein. 1959. Foliar Absorption of Sodium and Chloride as a Factor in Sprinkler Irrigation. Proc. Amer. Soc. Hort. Sci. 74:661-670). Those 1982 values having an "a" are significantly below toxic concentrations at $\alpha = 0.05$ using the t Test.

[b]Same as preceeding table.

[c]Same as preceeding table.

This is important because of accumulation of ions in the soil from the previous year's irrigation, prior to leaching from winter and early spring precipitation, may have been available for uptake by the vegetation. 3) Are 1982 treatment concentrations different than control area concentrations? The reasoning and justification for this question is the same as is explained for soils.

The results of the vegetation analysis are as follows:

- Fluoride: None of the species in any of the treatments exceed 20 ppm. This is well below the level where fluoride toxicosis has been observed in livestock or would be expected in wildlife (60 ppm). Chemical analysis only reported F levels as being less than 20 ppm. Therefore it is difficult to say that the 1982 levels were significantly less than 1981 levels, even though 1981 levels are close to or greater than 20 ppm in all species at all treatments.

- Boron: The 1982 concentrations for all three species and all treatments are significantly less than concentrations which can cause boron leaf toxicity (250 ppm). The 1982 levels were compared to 1980 levels, rather than 1981, because of the suspect low levels in 1981. Only the levels in big sagebrush were significantly less in 1982 than 1980. The 1982 treatment concentrations were not, for the most part, significantly different than 1982 Control area concentrations. Only treatments 5b and 6b for indian ricegrass (greater than) and treatment 7c for western wheatgrass (less than) were significantly different.

- Sodium: Only indian ricegrass in treatment 6b approached the toxicity range (2300 ppm - 6900 ppm) for Na. All other species and treatments were significantly less than the low end of the toxicity range. The 1982 levels for western wheatgrass were significantly different than 1981 levels (6b and 8b were less, 7c was greater). Indian ricegrass and big sagebrush 1982 levels were not significantly less than 1981, yet they were slightly lower. The 1982 treatment concentrations were not, for the most part, significantly different than the 1982 control areas. The exceptions to this were treatments 6b and 7c for both indian ricegrass and western wheatgrass (both were greater).

Chemical concentration in the foliage are significantly below their respective toxic limit ranges. Therefore, there should be little concern for continued plant productivity and animal consumption of the vegetation. Despite the increased concentration of sodium and boron in the soils, visual observation of the vegetation showed no signs of salt or boron damage. In fact, the concentration levels in the foliage has decreased. However, since there has been an increase in those parameters, continued visual observation of the vegetation is recommended.

The concentration of the parameters in the soil were significntly below respective toxic concentrations for most treatments. The concentrations which were considered toxic levels were for sensitive crops only. The vegetation in the irrigated area would not be considered as sensitive. Therefore, even though there was a slight increase in sodium and boron in 1982, the 1982 levels should not be of significant concern. However, as was mentioned previously, continued visual observation of the vegetation is recommended. The 1982 levels for the control area were also increased. These increases could be the result of yearly variations due to naturally occurring environmental factors such as climate. Unless visual observations of the vegetation detect salt or boron damage, future chemical analysis of the soils and vegetation should not be necessary until prior to re-use of the irrigation system.

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